Appendix 4

Terrestrial and Marine Wildlife

Freshwater and Marine Ecology Technical Report for Kodiak Airport Environmental Impact Statement, Kodiak, Alaska

Prepared for

Federal Aviation Administration

Alaska Department of Transportation and Public Facilities

Prepared by

SWCA Environmental Consultants

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KODIAK AIRPORT EIS

TECHNICAL REPORT ON FRESHWATER AND MARINE ECOLOGY

Prepared for

Federal Aviation Administration
Alaska Department of Transportation & Public Facilities

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CONTENTS

Attachments

Figures

Tables

Acronyms and Abbreviations

ADF&G	Alaska Department of Fish and Game
cfs	cubic feet per second
CEDS-I	Coastline Engineering, and Dynamic Solutions-International, LLC
CPUE	catch per unit effort
EFH	essential fish habitat
EIS	environmental impact statement
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FMP	fishery management plan
GAP	Gulf Apex Predator-prey [study]
ISC Kodiak	U.S. Coast Guard Base Integrated Support Command Kodiak
MLLW	mean lower low water
MHHW	mean higher high water
NAVD88	North American Vertical Datum, 1988
NAVFAC	Naval Facilities Engineering Command
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
ppt	parts per thousand
RM	river mile
RSA	runway safety area
SAIC	Science Applications International Corporation
SWCA	SWCA Environmental Consultants
USGS	U.S. Geological Survey
VAI	Vigil-Agrimis, Inc
WRCC	Western Regional Climate Center

1 INTRODUCTION AND PROJECT SETTING

This report summarizes the freshwater and marine ecology of fish and other aquatic organisms found in the waters surrounding the Kodiak Airport. This document focuses specifically on fish and aquatic organisms found in the lower Buskin River, its tributary Devils Creek, the Buskin River estuary, and nearshore marine areas in Chiniak Bay. Marine mammals and seabirds are addressed in a separate technical report (SWCA 2009a). This report will be used to support an environmental impact statement (EIS) that is currently being prepared for proposed expansion of runway safety areas (RSAs) at the Kodiak Airport. Kodiak Island is in the northwestern Gulf of Alaska, south of the Alaska Peninsula. The island is the largest in the Kodiak Island Archipelago. Kodiak Airport is on the northeastern shore of Kodiak Island within the Buskin River watershed and along a shallow-water portion of Chiniak Bay where depths are less than 300 feet (Figure 1-1). Surrounding waters reach depths up to 600 feet.

The Buskin River watershed covers approximately 26 square miles and ranges in elevation from nearly 2,250 feet at Barometer Mountain to sea level at St. Paul Harbor. The Buskin River is approximately 6.5 miles long and flows southeast to enter Chiniak Bay at St. Paul Harbor, immediately north of the Airport. Devil's Creek, the dominant stream in a sub-watershed within the larger Buskin River watershed, flows through the Airport and enters the Buskin River from the south; from the north, the significant tributaries are short streams draining from Lakes Catherine, Louise, and Genevieve (Figure 1-2). These tributaries converge with the Buskin River at approximate river mile (RM) 1.15 (NAVFAC 2004). Buskin Lake (see Figure 1-1) is approximately 4 miles upstream from tide water (VAI 2008a) and 250 acres in size (NAVFAC 2004). A detailed description of riparian vegetation at the lower elevations of the Buskin River watershed (i.e., the area indicated in Figure 1-2) is available in SWCA's technical report dealing with terrestrial vegetation and wildlife (SWCA 2009a). Riparian and marine vegetation are further described in **Section 3.2, *Freshwater Ecology, Habitat Characteristics*, and Section 4.2, *Marine Ecology, Habitat Characteristics*.**

Chiniak Bay is situated between Spruce Cape and Cape Chiniak (see Figure 1-1). Emergent rocks and shoals are located throughout the bay and there are many large and small islands, mostly grouped near Spruce Cape. The dominant features of the west-southwest coast of the bay are three large glacial inlets: Womens Bay, Middle Bay, and Kalsin Bay (see Figure 1-1). Numerous streams flow into Chiniak Bay and these inlets. The shallow western portion of Chiniak Bay between Womens Bay and the City of Kodiak is St. Paul Harbor. The Airport and the U.S. Coast Guard Base Integrated Support Command Kodiak (ISC Kodiak) are on the shore of St. Paul Harbor, near the mouth of the Buskin River (see Figure 1-1). The ***Study Area*** for this report consists of the lower Buskin River, beginning downstream of RM 1.3 where the Chiniak Highway bridge passes over the Buskin River, and includes the Buskin River estuary, the lower portion of Devils Creek, and the nearshore marine waters of Chiniak Bay around Runway ends 18, 25, 29, and 36 (see Figure 1-2). The Study Area was defined based on immediate proximity of marine and freshwater areas to the Airport. The Buskin River and Devils Creek were indicated as the freshwater bodies most likely to be directly impacted by the project (S. Maclean, ADF&G, personal communication, April 9, 2007). The marine portion of the Study Area was

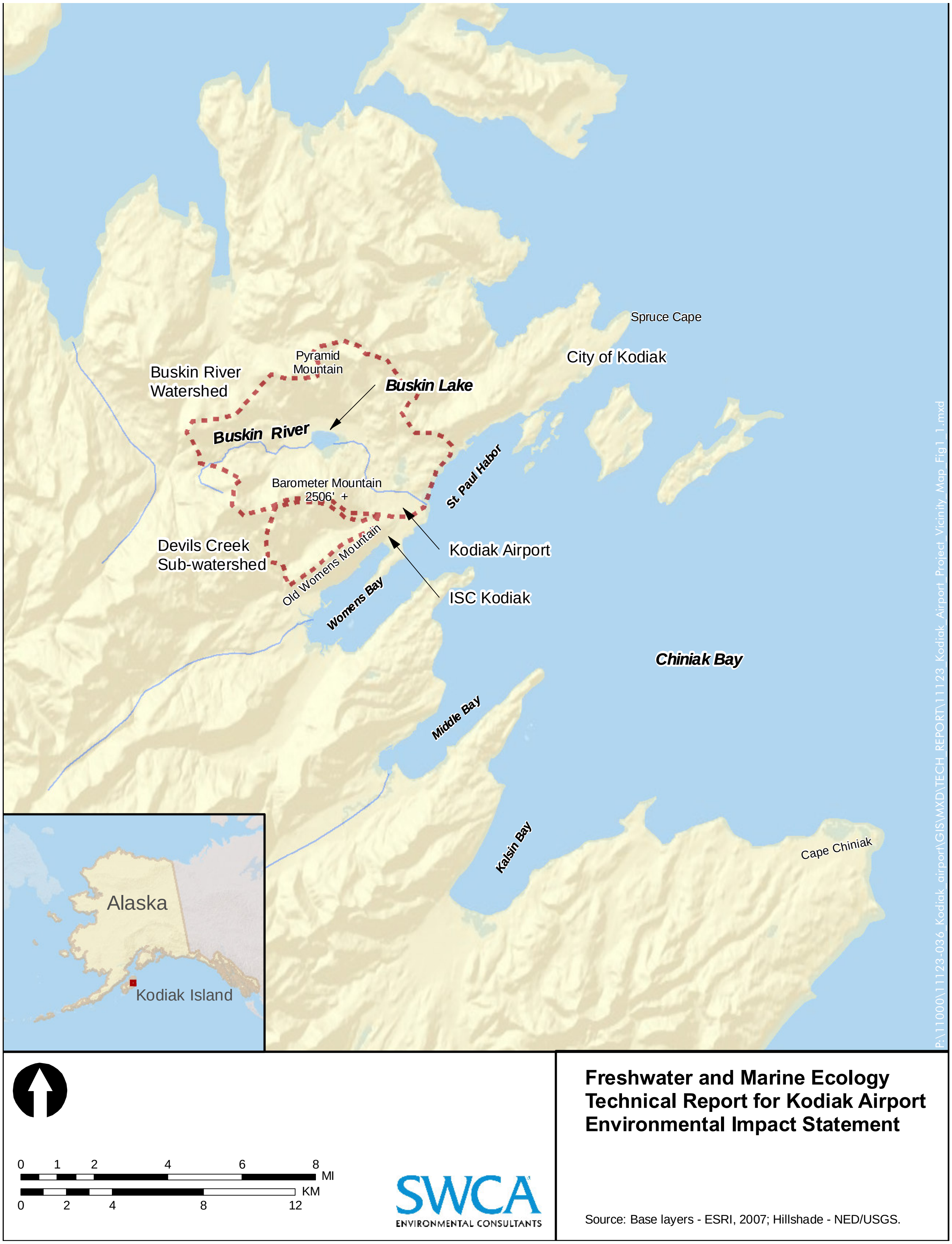

Figure 1-1. Project vicinity.

Figure 1-2. Project Study Area.

also defined based on its proximity to build-out scenarios available at the time this study was designed. SWCA Environmental Consultants (SWCA) conducted fieldwork in the Study Area during September 2007, from March through June 2008, and during November 2008, to document species presence and habitat use and existing habitat conditions.

2 METHODS

SWCA Environmental Consultants employed a variety of field sampling methods during 2007 and 2008, in order to better understand specific habitat conditions and target species (Table 2-1).

Table 2-1. Sampling Methods Detail for 2007 and 2008

Sample Method	Target Habitat	Target Species	Target Tide	Date of Sampling
Opai Net	Freshwater: small off-channel areas	Small fish, juvenile salmonids	Low and high tide	June 2008
Fyke Net	Freshwater: main channel areas	Small fish, juvenile salmonids	Low and high tide	September 2007, June 2008
Beach Seine	Freshwater and marine areas: all habitats	Fish	Low and high tide	September 2007, June 2008
Minnow Trap	Freshwater and estuarine areas	Small fish, juvenile salmonids	n/a	September 2007
Snorkel Survey	Freshwater and estuarine: areas with at least 2 feet of water	Fish	High tide	September 2007, June 2008
Dive (SCUBA) and Walking Surveys	Marine: intertidal and subtidal habitats	Fish and invertebrates; algae, substrate	Low and high tide	March–May 2008
Kick Net	Freshwater: areas with 3 feet of water or less.	Invertebrates	n/a	September 2007, June 2008
Drift Net	Freshwater: main channel areas	Invertebrates	n/a	June 2008
Water Quality	Estuarine: freshwater/marine interface	n/a, determine salinity intrusion	Low and high tide	June 2008
Kelp Surveys – Visual Estimate	Subtidal	Macroalgae and substrate	n/a	November 2008

Field surveys were conducted in September 2007 and June 2008 to determine

- The relative abundance and types of aquatic macroinvertebrates in the Buskin River estuary and Devils Creek.
- Fish presence, distribution, and timing of habitat use in Devils Creek, the Buskin River, the Buskin River estuary, and the marine side of Buskin River barrier bar.
- The extent of saltwater inflow in the Buskin River estuary at high tide.

Field surveys were conducted in March, April, and May 2008 to determine

- Habitat conditions on the marine side of Buskin River barrier bar (including intertidal and subtidal algae, fish, and invertebrate presence) and substrate composition.

Field surveys were conducted in November 2008 to

- Map subtidal kelp beds near Runway end 25.
- Determine substrate composition near Runway end 25.

2.1 Invertebrate Sampling

Freshwater invertebrates were sampled in September 2007 and June 2008 using kick nets (Devils Creek) and drift nets (Devils Creek and Buskin River estuary). Kick nets (0.02-inch mesh) were used to target various substrates and edge habitats that could not be sampled with drift nets. Material retained in the nets was sorted on a white tray with types and relative abundance of invertebrate groups noted.

Drift nets (0.004-inch mesh) were deployed in Devils Creek at the base of Devils Creek falls (near Runway end 7). Drift nets were deployed in the Buskin River estuary at three locations for an entire incoming and outgoing tide, regardless of tidal cycle duration. Drift nets were set at approximately the same time as the fyke nets (discussed under **Section 2.2., *Fish Sampling***), in order to compare invertebrate drift with fish presence. Nets were emptied at peak tide and turned to face the new direction of tidal flow. The volume of material collected in the nets was approximated, and the material was sorted on a white tray with types and relative abundance of invertebrate groups noted.

2.2 Fish Sampling

Fish were sampled in September 2007 and June 2008. Opai nets, which are small hand-held beach seines, were used to target small off-channel areas in the Buskin River estuary and edge habitat in Devils Creek; these nets had 0.25-inch mesh. Fyke nets (0.08-inch mesh) were used to sample four locations in the Buskin River estuary and one location in Devils Creek. Each trap was fished for an entire incoming and outgoing tide, regardless of the duration of tidal cycle. Traps were emptied at peak tide and turned to face the direction of the tidal flow. Beach seines (0.25-inch mesh) were used to sample the Buskin River estuary and the marine side of the barrier bar. In order to compare data, sites sampled in 2008 overlapped with those sampled in 2007. Snorkel surveys were used to determine fish use in the lower Buskin River and estuary during high tide.

2.3 Habitat Surveys

2.3.1 Intertidal and Subtidal Habitat Methods

Intertidal and subtidal habitat surveys were conducted in the Airport Study Area from March through May 2008 to document habitat characteristics. Survey objectives were to 1) document the existing habitat, including substrate composition, anthropogenic features, and boundaries between habitat types; 2) document existing dominant biota (algae and animals); and 3) create a photographic record of the habitat surveyed and correlate with GPS positions.

Surveys were focused on seven transect locations within the Airport Study Area.

- Three transects were located near Runway end 18.

    - One transect was parallel to the center axis of the runway, extending approximately 1,500 feet from the runway end.
    - One transect was perpendicular to the runway, within 1,000 feet of the runway end.
    - One transect was perpendicular to the runway, beyond 1,000 feet of the runway end.
- One transect was located parallel to the center axis of Runway end 25, extending 1,500 feet from the end of the runway and into the bay.
- One transect was located between Runway ends 25 and 29, extending 1,000 feet into the bay.
- Two transects were located near the base of Runway end 36 (Jewel Beach).
    - One transect was parallel to the center axis of the runway, extending 1,500 feet from the base of the runway end;
    - One transect was within 1,000 feet of the runway end, extending perpendicular to the runway and up to 1,000 feet into the bay.

General transect position was selected randomly from a map of the area. Exact placement of transect origin was selected by a random toss and then oriented parallel to the center axis of Runway end 25.

Additional quadrats were sampled on the southern intertidal extent of Jewel Beach. Although slightly beyond the proposed footprint of RSA construction, this area is substantially different from other intertidal areas in the Airport Study Area. These additional quadrats were included to provide baseline data.

2.3.2 Intertidal Habitat Sampling

Intertidal transect surveys were conducted in March and April 2008. Transect lines were established in the field and marked with a GPS. The length of each transect was walked to the extent exposed by the tide. In addition, habitat boundaries, such as a change in substrate composition, were delineated by walking the length of the boundary to establish a GPS trackline of the habitat edge.

For each transect, quadrat survey locations were randomly selected by tossing a 2.7-square-foot quadrat from the transect line. Substrate composition was estimated within each quadrat. Total substrate composition reflects a percentage of each of the following categories: sand, gravel, cobble, and bedrock. During the surveys, shell debris and ash were recorded as separate substrate categories, but they were not found often or in substantial percentages. Therefore, shell debris was added to the cobble category, and ash was added to the sand category. Crustose coralline algae and barnacles were also initially separated as unique substrate categories. However, because these categories reflect biota attached to substrate, they were later reclassified to the appropriate geological substrate category. Percent cover of dominant algae and invertebrates was recorded; identifications were made to the species level if possible. As appropriate, some invertebrates were enumerated rather than recorded as percent cover. Quadrats were photographed and marked with a GPS unit. Up to four quadrats were surveyed for each habitat type.

2.3.3 Subtidal Habitat Sampling

In May 2008, subtidal transect surveys were conducted using SCUBA. The previously surveyed intertidal transects were located with a GPS unit. These transects were extended further into the subtidal area and marked with GPS. Divers swam the length of each transect in the previously surveyed intertidal areas and in the subtidal, or permanently submerged, portions of the transect line. This overlap allowed divers to determine fish use of the previously surveyed intertidal areas when submerged during high tide. Following the placement of transects, divers left the area undisturbed for 0.5 hour prior to conducting the surveys.

Transect survey methods varied depending on the target flora or fauna. Belt transects were surveyed for presence and abundance of fish, crabs, and canopy-forming kelp (i.e., bull kelp [*Nereocystis leutkeana*] and dragon kelp [*Alaria fistulosa*]). For each belt transect, fish, crabs, and canopy kelp were identified and counted. The area surveyed for crab and kelp spanned a swath of approximately 12 feet (6 feet on either side of the transect mid-line). Buried crabs were located by swimming close to the bottom to detect protruding crab eyestalks. Fish within visual range in front of the diver, or to either side, were identified and enumerated. For fish, the width of pelagic survey transects was estimated as twice the visibility at 3 feet off the bottom, or 12 feet. The height of the transect swath area was estimated as surface or a maximum of 12 feet at the deeper ends of transects. Schools of fish were recorded on a presence basis, since it was not possible to accurately estimate the individual number of fish.

While the fish surveys were being conducted by one diver, a second diver quantified macroalgal percent cover and determined bottom substrate composition along the transect using a combination of techniques. Belt transect and quadrat measurements were used to sample algae (canopy, overstory, and turf), resulting in multiple layers of algal composition data to describe this three-dimensional habitat. Canopy-forming kelp were counted along the entire 12-foot-wide (6 feet per side) swath of transect, covering the same area surveyed for crab presence.

Quadrats were used to quantify smaller macroalgae, sessile and mobile benthic invertebrates, and substrate composition. The quadrats were randomly placed adjacent to the transect line. Overstory kelp stipes and juvenile canopy kelp were counted and identified within the quadrat. The percent cover of small understory red algae, geniculate coralline algae, crustose coralline algae, and clump- or colony-forming sessile invertebrates (e.g., mussels and barnacles) were also estimated within these quadrats. Mobile marine invertebrates and solitary sessile invertebrates (e.g., anemones) were identified and individually enumerated. Along with biotic counts in each quadrat, the composition of bottom substrate particle size (from the categories of sand, gravel, cobble, and bedrock) was characterized as a percentage of the total substrate to determine its suitability for algal colonization and as a habitat for sessile invertebrates.

Up to four replicate quadrats were randomly sampled for each habitat zone encountered on each transect line. Subtidal quadrat locations were marked with a surface float, and location data were subsequently collected using a GPS unit from the dive vessel. Underwater photos were taken of each quadrat.

2.3.4 Kelp Bed Survey

A separate habitat survey effort was conducted in November 2008 to define the inshore boundaries of the kelp bed located east of Runway end 25. The kelp boundaries were found to be discontinuous rather than distinct; in essence, the kelp boundary consisted of patchy areas of kelp of varying cover densities interspersed with barren sand areas. Methods were modified in the field to optimize data collection.

Water clarity was good during the survey, allowing for a series of visual estimates to be made from the boat. Estimates were made and recorded while the boat was moving along lines oriented roughly parallel to the axis of Runway end 25. Each measurement location was recorded on a GPS unit. A total of 71 locations were surveyed from the boat, covering a much greater area than could be sampled with SCUBA observations.

The percent cover of kelp and apparent bottom substrate beneath the boat observer was estimated in an area of approximately 13 square feet. Substrate was classified into the two dominant categories: rock (which included both cobbles and gravel) and sand. If the substrate was covered by kelp, it was assumed to be suitable material for attachment by kelp holdfast and was therefore recorded as rock. Algal species composition was recorded at each survey point when depth and glare allowed adequate visibility.

2.4 GIS Mapping Methods

To develop maps for this report, substrate and algal coverage were modeled by SWCA using GIS data and aerial imagery. Volumetric calculations were also made from GIS data.

2.4.1 Interpolation Methods for Northern Substrate and Algae

Points with useable substrate sample information were identified and the extents of sub-areas (e.g., Runway ends 18, 25, 37) were identified. With these model inputs established, three different interpolation methods were used: inverse distance weighting, ordinary spherical kriging, and ordinary linear kriging, using a different number of nearest neighbors to estimate a continuous surface of each substrate component. Following the application of these methods, the resultant grids were assessed to determine which grids did not fit the data. The meaningful outputs were then averaged into a mean substrate dataset (mean sand, mean gravel, mean rock), and the following conditional statement was written, which looks for the greatest value of any of the set of values (i.e., sand, gravel, rock).

> CON([grid1] >= [grid2] and [grid1] >= [grid3], [grid1], CON([grid2] >= [grid1] and [grid2] >= [grid3], [grid2], [grid3]))

For example, for an area with values of 25% rock, 25% cobble, and 50% sand, the resultant grid would represent sand as the generalized majority substrate of the area based on the sample points. The modeled substrate was modified based on field photos and aerial imagery to better represent the data collected in the field. With the exception of rock armor, uplands (i.e., areas above 9.53 feet) were omitted. In some instances, the model generated inadequate descriptions of substrate when compared to field data and aerial imagery. In these instances, the model’s output (i.e., the map) was modified to include areas of cobble and gravel composition that were apparent from other data sources.

Kriged models predicted algal presence and composition in a manner similar to substrate. Kelp and other algal species were not present across the entire northern Study Area. The models indicate predicted percentages of these algal categories.

2.4.2 Modeling Methods for Southern Substrate and Algae

To maintain consistency, the southern portion of the Study Area was kriged in the same manner as the northern portion. However, the sample plots were not sufficiently dense to create useable substrate or algae models. Instead, the sample plots and statistical surfaces served as a guide to interpret the aerial imagery. Features visible in the aerial imagery appear to match the data from the sample plots consistently. Where available, photographs were referenced to add confidence to the substrate results. Quadrat data indicated that presence of coarse substrates (bedrock, cobble, and gravel) dictated the presence of algae. Unlike in the northern portion of the Study Area, kelp was not observed in sampled quadrats. Field photos, dive data, aerial imagery, and diver observations confirmed the accuracy of the algae covered substrates represented on the map.

2.4.3 Volumetric Calculations

Using bathymetric and topographical contours provided by Barnard Dunkelberg, a digital elevation model was interpolated. A raster was created for all values less than mean sea level (5.25 feet). Volume was calculated by multiplying surface area by the water column depth generated from the contours.

3 FRESHWATER ECOLOGY

3.1 Introduction

This discussion of freshwater ecology covers the aquatic habitat and biotic communities documented in the Study Area, namely fish and other aquatic organisms in the freshwater and estuarine habitats along the north side of the Airport property, including the tidally influenced lower Buskin River, and the non-tidal portions of the Buskin River system that flow through the Airport property. Habitat characteristics, biotic communities, and habitat functions are described separately for the Buskin River, Buskin River estuary, and Devils Creek.

3.2 Habitat Characteristics

3.2.1 Buskin River

The Buskin River watershed covers approximately 26 square miles (VAI 2008a). Steep mountains make up the western and northern boundaries of the watershed, with Old Womens Mountain and Barometer Mountain rising prominently to the south of the river and Pyramid Mountain to the north. The watershed receives, on average, annual precipitation of 68 to 75 inches (VAI 2008a; WRCC 2008). Average flow of the Buskin River is estimated at approximately 121 cubic feet per second (cfs), with a calculated low flow of 5.6 cfs (USGS 1990), a two-year peak discharge of 1,700 cfs, 10-year peak discharge of 2,870, and 100-year peak discharge of 4,480 (VAI 2008a). On Kodiak Island, peak streamflow typically occurs in early to mid summer, when increased snowmelt during high temperatures combines with heavy rain events (VAI 2008a). The underlying bedrock of the entire island is shale. The Buskin River valley in the Study Area has thicker glacial alluvial deposits than most of the nearby riverine systems in the area. The alluvium is chiefly composed of sands, gravels, and floodplain deposits, with areas of well-sorted volcanic ash deposits (SAIC 1995).

Riverbanks in the lower Buskin River were surveyed by the Alaska Department of Fish and Game (ADF&G) in 1995 (Schwarz 1995). Features noted in the lower river during the ADF&G surveys included naturally eroding cutbanks, which contribute alluvial floodplain sediments to the channel. Active bank erosion was documented in 7% of the tidally influenced portion of the river. Tidal action was indicated as the primary cause of erosion in lower lagoon areas, with foot traffic from visitors to Buskin River State Recreation Site also resulting in additional erosion (Schwarz 1995). Use of the state park for fishing and recreation will likely continue to be a source of bank erosion within the lower portion of the Buskin River.

Vegetation along the lower Buskin River in the Study Area consists primarily of high-brush vegetation, such as Scouler and Sitka willow (*Salix scouleriana* and *S. sitchensis*), Sitka alder (*Alnus sinuata*), Sitka spruce (*Picea sitchensis*) in some uplands, and wavy-leaved alder (*Alnus sinuata*) and black cottonwood (*Populus trichocarpa*) in some riparian areas. Understory vegetation includes bluejoint (*Calamagrostis canadensis*), salmonberry (*Rubus spectabilis*), sheep sorrel (*Rumex acetosella*), fireweed (*Epilobium angustifolium*), Sitka brome (*Bromus stichensis*), Oregon avens (*Geum macrophyllum*), sedges (*Carex* spp.), fescue grasses (*Festuca* spp.), common plantain (*Plantago major*), cow parsnip (*Heracleum lanatum*), green false hellebore (*Veratrum viride*), Canada goldenrod (*Solidago canadensis*), devil's club (*Oplopanax horridus*), Nootka lupine (*Lupinus nootkatensis*), Jacob's ladder (*Polemonium* spp.), Sitka rose (*Rosa rugosa*), ferns, including lady fern (*Athyrium flilix-femina*), red elderberry (*Sambucus racemosa*), and various mosses (SAIC 1995; VAI 2008a, 2008b).

Development of the facilities now known as U.S. Coast Guard Base Integrated Support Center Kodiak (ISC Kodiak) and the Airport began in 1939 as part of a U.S. military installation. During the construction, up to 20 feet of artificial fill was added to the riverbank. Prior to military development in the area, the lower Buskin River was a freely meandering alluvial-plain channel (SAIC 1995). Portions of the lower river still meander through lowland meadow/marsh habitat, mostly within the estuary reach. In the Study Area, the Buskin River exhibits low sinuosity (VAI 2008a). Between Chiniak Highway and the estuary, the Buskin River gradient is approximately 3.5% (DOWL Engineers 2007) and is moderately constrained by hill slopes and terraces. The lower Buskin River has been divided for the EIS studies into five reaches (Figure 3-1), based on dominant hydraulic processes (fluvial or tidal), slope, entrenchment, bed material, and channel form. The majority of the Study Area is included in these designated reaches. The following summary of the five reaches is taken from *Kodiak Airport EIS Water Resources Technical Memorandum* (VAI 2008a).

The uppermost reach is confined by large bedrock formations and is characterized by long riffles and deep pools. The next reach downriver is also constrained by bedrock but is characterized by a long, deep, and straight channel that is dominated by cobbles mixed with small boulders. In the middle reach, the channel becomes braided and small, heavily vegetated islands are interspersed between the channels; substrates are dominated by coarse gravels to small cobbles. Below the braided channel reach, the river is characterized by a series of deep pools and riffles. The head of tide (i.e., the point farthest upstream where flows are tidally influenced) extends to the upriver boundary of this reach where it joins the multichannel reach. Stream substrates in this reach are variable and include fine gravels to small cobbles mixed with small boulders. Road fill (embankment) between the Buskin River State Recreation Site access road and the river remains from a bridge that once spanned the river. The river flows south in a right angle bend before it turns east along the Airport and enters the estuary reach. The bridge described above is not present in a 1951 aerial photo but is shown in photos from 1967 (Figure 3-2 and Figure 3-3). The bridge remnants appear in aerial photos from 1990 and 1996 (Figure 3-4 and Figure 3-5). The lowest reach of the river is the estuary reach, and it is discussed in **Section 3.2.2, *Buskin River Estuary***.

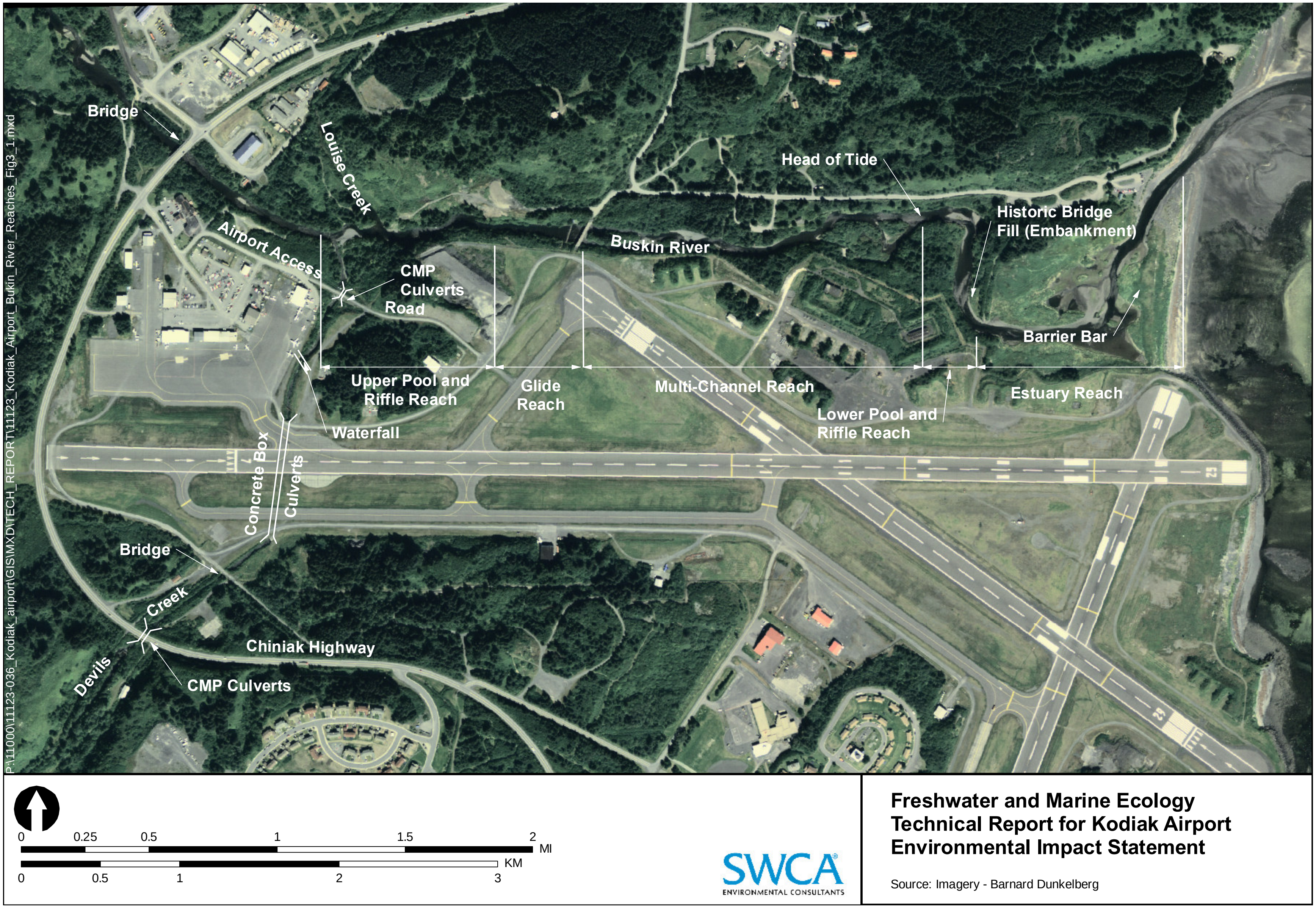

Figure 3-1. Lower Buskin River reaches.

Figure 3-2. Buskin River mouth, 1951.
Source: Barnard Dunkelberg

Figure 3-3. Buskin River mouth, 1967.
Source: Barnard Dunkelberg

Figure 3-4. Buskin River mouth, 1990.
Source: Barnard Dunkelberg

Figure 3-5. Buskin River mouth, 1996.
Source: FAA 2005

3.2.2 Buskin River Estuary

The Buskin River estuary is north and northwest of Runway end 18. The estuary is defined in this report as the area influenced by tide and salinity, and it includes the Buskin River channel downstream from the middle of the fill approach of the remnant bridge crossing and associated tidal wetlands (see Figure 3-1). The estuarine reach of the Buskin River is characterized by a wide meandering channel with an approximate gradient of 0.1% (VAI 2008a). Channel substrates are characterized by fine silts and sands, with some areas of small cobbles (VAI 2008a). There is also a broad tidal marsh north of the river channel and a smaller tidal marsh area south of the channel. Water surface elevations in this reach range from 0.76 feet North American Vertical Datum, 1988 (NAVD88) at mean lower low water (MLLW) to 9.53 feet (NAVD88) at mean higher high water (MHHW) (VAI 2008a).

The estuary and ocean are separated by a sand and rock barrier bar that has periodically migrated. Changes to the size and shape of the barrier bar, as well as the location of the outlet of the Buskin River, are evident in historical aerial photographs and information obtained from local residents. Survey drawings from 1941 and aerial photographs taken between 1951 and the present were examined to compare movement of the barrier bar and location of the river mouth (see Figures 3-2, 3-3, 3-4, and 3-5). At present (January 2009) the barrier bar extends north from the land adjacent to Runway end 18 and directs the Buskin River flow northward into St. Paul Harbor; this observation of the mouth and barrier bar location is consistent with photographs taken in 1990 and 1996. The survey drawings from 1941 and photographs from 1951 and 1967 illustrate the changing nature of this feature. In 1941 and 1951, the river mouth was adjacent to the north of Runway end 18, and the barrier bar extended south from the north bank of the river. Two barrier bars are present in the 1967 aerial photograph; one bar extended south from the north bank of the river, and a smaller bar extended north of Runway end 18. The river mouth was between them.

In addition to changes in the location and morphology of the river mouth and barrier bar, another change relating to the estuary is notable. The tidal marsh that exists now on the north side of the river is not visible in the 1951 photograph, and upland vegetation appears to be growing across that area. The tidal marsh is clearly visible in the 1967 photo (see Figure 3-3). Possible explanations for these differences include transformations resulting directly from the 1964 Good Friday Earthquake and subsequent tsunami, reconstruction following the earthquake and tsunami (VAI 2008a), or changes in topography resulting from grading and/or soil removal activities related to past construction projects. The alignment and location of the river mouth has changed over the period for which historical documentation is available, but does not appear to move frequently to different locations along the barrier bar. One possible explanation is the barrier bar builds northward as a result of sediment transport from the south, progressively moving the outflow of the Buskin River northward. The river mouth may reset to a more southern location during storms or high tide events (CEDS-I 2008). The location of the river mouth could also shift dramatically as a result of seismic events.

Limited information is available on circulation, tidal mixing patterns, effects of seasonal and tidal salinity fluctuations, and extent of saltwater intrusion in the estuary. Based on field observations described below, the estuary is considered to be a salt wedge estuary, in which saltwater moves upstream from the ocean along the bottom of the river channel during rising tides. On September 11, 2007, SWCA measured salinity in the estuary. The furthest upstream extent of salinity was recorded approximately 0.25 mile upstream from the river mouth, in the large wetland area on the north side of the river (Figure 3-6). A salinity measurement of 4.5 parts per thousand (ppt) was recorded during the flood tide and reflects brackish water conditions; marine saltwater is typically 35 ppt. The observed tidal height at the Kodiak Island Tidal Station (ID 9457252) in Womens Bay was 6.16 feet MLLW (NOAA 2008a) at the time the measurement was recorded. Freshwater and brackish water conditions were recorded in the main channel downstream of the wetland salinity measurement location. Salinity tended to increase with proximity to the river mouth and was higher at depth than at the surface of the water. The highest salinity recorded in the river channel (16.0 ppt) was recorded downriver from the parking lot area (see Figure 3-6). Measurements taken by Vigil-Agrimis the following day were comparable (VAI 2008a).

In June 2008, SWCA recorded salinities in the estuary on three days. Salinity was measured in the wetland area on June 20 and was 0.15 ppt (see Figure 3-6). This measurement was taken in an isolated pool that formed following tidal outflow. Although the tide was incoming at the time this measurement was recorded, the pool was still disconnected from flow in the river channel. The observed tidal height at the Kodiak Island Tidal Station was 5.16 feet MLLW (NOAA 2008a). Salinity was measured in the main channel of the estuary on June 17 and 18. In general, salinity measurements recorded during June 2008 were much lower than measurements recorded in September 2007; most samples taken in the main channel of the estuary in 2008 ranged from 0.01 to 0.02 ppt. The highest salinity recorded in the estuary during 2008 was 2.44 ppt. This measurement taken at the site closest to the river mouth and was further downstream than any sites measured in September 2007 (see Figure 3-6). June 17 salinities were recorded beginning at slack high tide and continued as the water began ebbing. Kodiak Island Tidal Station tidal height observations ranged from 5.79 to 5.06 feet MLLW (NOAA 2008a). June 18 salinities were recorded during slack high tide, and Kodiak Island Tidal Station tidal height observations at that time ranged from 6.06 to 5.94 feet MLLW (NOAA 2008a).

The higher salinity measurement recorded in the wetland area in June 2008 may have resulted from brackish water that remained trapped in the pools that form following tidal outflow. In general, saltwater flows up the Buskin River to at least the wetland area. Salinities in this portion of the estuary may fluctuate rapidly, and this is likely a part of the saltwater/freshwater transition zone. Saltwater inflow and mixing in estuaries are related to river discharge, tide height, and possibly storm surge effects. The size, shape, and configuration of the river mouth in relation to the Buskin River barrier bar can also be a factor in the dynamics of saltwater inflow. In turn, salinity variations generally affect the presence and distribution of fish and invertebrates in estuarine habitats.

The intertidal area adjacent to the river channel consists of vegetated intertidal marsh and unvegetated flats. The marsh and tidal flats are drained by a network of tidal channels that connect to the main Buskin River channel. The Buskin River estuary has approximately 9.6 acres of estuarine intertidal wetland dominated by persistent emergent vegetation (VAI 2008b). The frequently inundated lower elevation areas of the tidal wetland are dominated by Lyngbye's sedge (*Carex lyngbyei*) and mud sedge (*C. limosa*); the less frequently inundated higher elevations are dominated by a dunegrass (*Elymus mollis*) and bluejoint (*Calamagrostis canadensis*) community (VAI 2008b).

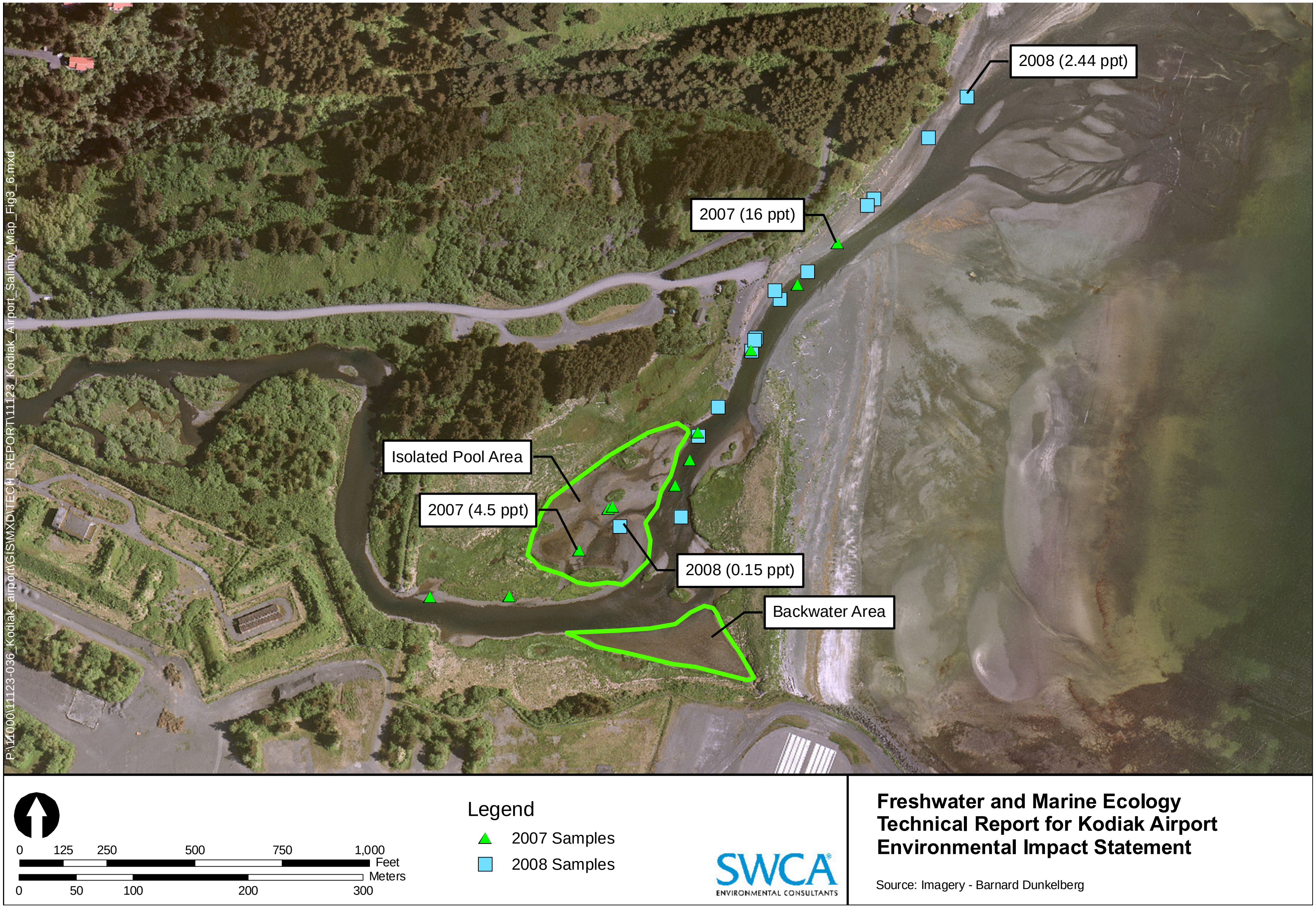

Figure 3-6. Buskin River estuary salinity sampling points from 2007 and 2008 field surveys.

The tidal flats receive local accumulations of detritus from the marsh and some marine algae carried into the estuary by tides. During September 2007 surveys, carcasses of pink salmon (*Oncorhynchus gorbuscha*) were abundant throughout the estuary.

3.2.3 Devils Creek

Devils Creek flows to the northeast through the Airport before entering the Buskin River at RM 1.15. Within the Study Area, the creek's channel has a fairly straight trajectory and is confined between high banks. The creek banks are highly altered due to past airfield development and to armor the channel from erosion and lateral movement. Bankfull width in the Study Area ranges between 32 and 47 feet, with an average of 38 feet (VAI 2008a). Substrates in this portion of the creek are dominated by cobble and gravel. Riparian vegetation is dominated by shrubby alder, grasses, and willow; other areas are lined with rock armor.

There are also three sets of side-by-side culverts through which the creek has been diverted. The downstream-most culverts pass under an Airport service road approximately 300 feet upstream from the creek's confluence with the Buskin River. This set consists of double corrugated metal pipe culverts, each 12 feet in diameter and 60 feet long (VAI 2008a). Between the mouth and these culverts, the creek consists mostly of riffles, with a pool directly below the outflow from the culverts. These culverts are not an impassable barrier to fish, as anadromous salmonids were observed above and below them during field surveys in September 2007 and June 2008.

Upstream from the first set of culverts, there is a waterfall that cascades over bedrock and is 11 feet tall (VAI 2008a; see Figure 3-1). The creek below the waterfall consists primarily of riffles, with the exception of a cascade plunge pool directly upstream from the opening to the first set of culverts. A small pool is located on the downstream right side of the falls, approximately halfway down the falls. Bedrock constricts the channel. The creek gradient downstream from the waterfall is approximately 1.9% (VAI 2008a). Juvenile Dolly Varden char (*Salvelinus malma*) were observed above the falls in September 2007 and June 2008. Because there are resident forms of this species and because no strictly anadromous fish species were observed above the falls, it is not known whether the falls are a complete barrier to fish passage.

Upstream from the waterfall, a set of double concrete box culverts passes underneath Runway end 7 and a taxiway. The culverts are 750 feet long, and each box is approximately 6 feet high by 10 feet wide (VAI 2008a). Riffles are common between the falls and these culverts, and there are small pools below the culvert outflows. Riffle substrates are dominated by bedrock and gravels. A narrow band of streamside vegetation is limited by the Airport taxiway and service road bordering each side of the creek. Vegetation height is also limited to short shrubs, willows, grasses, and forbs between the falls and runway culvert. It is not known whether the middle set of culverts is a barrier to fish passage.

The third set are double corrugated metal pipe culverts that are 120 feet long and approximately 5 feet tall (VAI 2008a). They are located just outside of the southwest boundary of the Airport and pass under an Airport service road. A pool is below the outflow from the culverts and some broken quarry rocks are present. Approximately 500 feet of channel in this reach is lined with wood planks along the sides and bottom (VAI 2008a). Riffles dominate this reach and substrates range from large cobble to gravel. The Study Area within Devils Creek ends at the outflow from the third set of culverts. It is not known whether these culverts are a barrier to fish passage. Within the Study Area, the creek slope upstream from the waterfall is approximately 1.5%.

3.3 Biotic Communities and Populations

3.3.1 Buskin River

Salmonids in the Buskin River basin include pink salmon, chum salmon (*Oncorhynchus keta*), coho salmon (*O. kisutch*), steelhead/rainbow trout (*O. mykiss*), sockeye salmon (*O. nerka*), and Dolly Varden char. The river is used seasonally by both outmigrating juveniles and spawning adults. Some trout and Dolly Varden may occupy the Buskin River throughout their lifecycle. Steelhead trout and rainbow trout are common names for a single distinct species that displays two different life history strategies; steelhead trout are anadromous and rainbow trout live solely in freshwater. The disposition of the parent fish does not predetermine the disposition of the offspring fish, and both life history strategies may emerge from a single cohort. In most instances throughout this report, discussion of this species will include both anadromous and resident life history forms, unless discussing a particular trait applicable to only one form. Similarly, Dolly Varden exhibits both life history strategies; however, the same common name is used for both types of Dolly Varden, regardless of life history strategy. For an overview of when and for what purposes different salmonids use the Buskin River, see Attachment A and Attachment B. Fish populations in the Buskin River are described from existing information and fieldwork conducted during fall 2007 and spring 2008.

3.3.1.1 Existing Information on Buskin River Fish Populations

Three seasonal fish weirs are operated by ADF&G in the Buskin River system to provide data on salmon migration (Schmidt et al. 2005, L. Schwartz, ADF&G, personal communication, January 28, 2008): the Lake Louise weir, the Buskin Lake weir, and the lower Buskin River weir. The Lake Louise weir is located in Louise Creek below its confluence with Lake Louise. The Buskin Lake weir is located in the Buskin River below its confluence with Buskin Lake. The lower Buskin River weir is located at RM 1.5, approximately 0.25 mile upstream from the Chiniak Highway (Schmidt et al. 2005, L. Schwartz, ADF&G, personal communication, January 28, 2008).

Adult returns in 2007 at the Louise Creek weir, where 1,662 sockeye, 375 pink, and 259 coho (L. Schwarz, ADF&G, personal communication, April 4, 2008). Information on fish presence and distribution in tributaries of the lakes and on specific spawning locations is minimal (Schmidt et al. 2005). The timing of sockeye and pink salmon returns to Lake Louise is later than the return timing of those same species to Buskin Lake (Tracy 2008).

Lakes Catherine and Louise support coho and pink salmon runs and were stocked with steelhead/rainbow trout in the 1950s (ADF&G 1957); sockeye had been previously documented in the lakes and their outlet streams (ADF&G 1957). During seine sampling surveys in Buskin Lake, ADF&G noted coho in the lake (L. Schwarz, ADF&G, personal communication, January 28, 2008).

According to data from the lower Buskin River weir, 98 chum salmon, 8,366 coho salmon, 80,851 pink salmon, and 16,499 sockeye salmon returned to the Buskin River in 2007 (L.

Schwarz, ADF&G, personal communication, April 4, 2008). The Buskin River has an average annual escapement of 99,000 pink salmon and 16,500 coho salmon. Minimal steelhead information is available but escapement is likely 300 to 500 (S. Maclean, ADF&G, personal communication, April 9, 2007). Variation in sockeye escapement should be noted. The Buskin River sockeye escapement goal is 8,000 to 13,000 fish, and between 1996 and 2005 yearly escapement averaged 15,500 fish (S. Maclean, ADF&G, personal communication, April 9, 2007). Actual counts of sockeye in 2008 were so low that the Buskin River was closed for sockeye fishing in June 2008. At the time of the Buskin River weir closure on September 29, 2008, the cumulative sockeye count was 5,900 fish; that is the lowest sockeye count on record for the Buskin River (ADF&G 2008a).

Though there are no active fish hatcheries in the Buskin River basin today, from the 1950s to the 1990s, salmonid runs in the Buskin River were periodically supplemented with hatchery releases. A hatchery for steelhead/rainbow trout was built in 1952 and 1953 on the Kodiak Naval Station on Devils Creek, just upstream from the Airport. Eggs for the hatchery were collected from the Karluk River on Kodiak Island. From the early 1950s to the 1980s, hatchery steelhead/rainbow trout from this Devils Creek hatchery were planted in Buskin Lake and Lakes Catherine, Genevieve, and Louise in an effort to offset overfishing (ADF&G 1956, 1957; Kodiak Military History Museum 1999). In 1983 and 1984, coho salmon were stocked in the Buskin River and Lake Genevieve with Buskin River coho eggs raised at the Pillar Creek Hatchery on Kodiak Island (Murray 1986). Lake Genevieve is known to have historically supported small populations of coho and sockeye (Murray 1986). From 1994 to 1995, approximately 100,000 Chinook salmon smolts from Elmendorf Hatchery in Anchorage were released in the Buskin River in an effort to establish a recreational Chinook salmon fishery along the Kodiak road system (Schwarz 1995). Currently, native Kodiak Island Chinook salmon occur only in the Karluk and Ayakulik River systems on the remote southwest side of the island (ADF&G 2007), but may be found year round in Chiniak Bay (S. Maclean, ADF&G, personal communication, April 9, 2007). Adult Chinook occasionally stray into the Buskin River.

3.3.1.2 Field Observations of Buskin River Fish Populations

SWCA identified numerous species of salmonids and non-salmonids in 2007 and 2008 (Table 3-1 and Table 3-2).

Table 3-1. Salmonid Fishes Identified in the Airport Study Area during 2007–2008 Field Surveys

Common Name	Scientific Name	Year	Location Observed[1]		
			Freshwater	Estuary	Marine
pink salmon	***Oncorhynchus gorbuscha***	2007, 2008	*	*	*
chum salmon	***Oncorhynchus keta***	2008		*	*
coho salmon	***Oncorhynchus kisutch***	2007, 2008	*	*	*
steelhead / rainbow trout	***Oncorhynchus mykiss***	2007, 2008		*	
sockeye salmon	***Oncorhynchus nerka***	2008	*	*	
Dolly Varden char	***Salvelinus malma***	2007, 2008	*	*	*

[1] ***Freshwater*** indicates that fish were observed during snorkel or walking surveys, or were collected in fish traps or kick nets. ***Estuary*** indicates that fish were observed during beach seine or snorkel surveys, or were collected in fish traps. ***Marine*** indicates that fish were observed during beach seine surveys.

Table 3-2. Non-salmonid Fishes Identified in the Airport Study Area during 2007–2008 Field Surveys

Common Name	Scientific Name	Year(s)	Location Observed[1]		
			Freshwater	Estuary	Marine
Smelts:					
surf smelt	***Hypomesus pretiosus***	2008			*
Cods:					
Pacific tomcod	***Microgadus proximus***	2008			*
walleye pollock	***Theragra chalcogramma***	2008			*
unidentified cod	Family Gadidae	2008			*
Sticklebacks:					
threespine stickleback	***Gasterosteus aculeatus***	2007, 2008	*	*	*
Sculpins:					
buffalo sculpin	***Enophrys bison***	2007, 2008		*	*
Pacific staghorn sculpin	***Leptocottus armatus***	2007, 2008	*	*	*
great sculpin	***Myoxocephalus polyacanthocephalus***	2008			*
tidepool sculpin	***Oligocottus maculosus***	2008			*
unidentified sculpin	Family Cottidae	2007, 2008	*	*	*
Poachers:					
tubenose poacher	***Pallasina barbata***	2008			*
sturgeon poacher	***Podothecus accipenserinus***	2008			*
unidentified poacher	Family Agonidae	2008			*
Snailfishes:					
spotted snailfish	***Liparis callyodon***	2008			*
unidentified snailfish (Liparidae)	***Liparis*** sp.	2007		*	
Sandfishes:					
Pacific sandfish	***Trichodon trichodon***	2008			*
Sand Lances:					
Pacific sand lance	***Ammodytes hexapterus***	2008			*
Righteye Flounders:					
butter sole	***Isopsetta isolepis***	2008			*
rock sole	***Lepidopsetta*** spp.	2008			*
starry flounder	***Platichthys stellatus***	2007, 2008		*	*
sand sole	***Psettichthys melanostictus***	2008			*
unidentified righteye flounders	Family Pleuronectidae	2007, 2008			*

[1] ***Freshwater*** indicates that fish were observed during snorkel or walking surveys, or were collected in fish traps or kick nets. ***Estuary*** indicates that fish were observed during beach seine or snorkel surveys, or were collected in fish traps. ***Marine*** indicates that fish were observed during beach seine surveys.

During fieldwork in September 2007, adult pink salmon were abundant throughout the lower Buskin River, and they were observed spawning in Devils Creek and the lower Buskin River. Fieldwork coincided with the end of the spawning run and numerous carcasses were observed. The estimated size of the pink salmon spawning run for 2007 was 82,000 fish (L. Schwarz, ADF&G, personal communication, April 4, 2008).

Adult coho salmon were at the beginning of their spawning run during the September 2007 surveys and were observed in substantially fewer numbers than pink salmon. Although active spawning behavior was not observed, a large school of adult coho salmon was seen holding in a pool on the south side of the Buskin River, directly below the confluence with Devils Creek. Adult and juvenile Dolly Varden, as well as juvenile coho and steelhead/rainbow trout were documented in the lower Buskin River. Other species recorded in the freshwater reaches of the river during SWCA's fieldwork in 2007 and 2008 were threespine stickleback (*Gasterosteus aculeatus*) and Pacific staghorn sculpin (*Leptocottus armatus*).

3.3.2 Buskin River Estuary

The estuary has not been extensively studied, and information pertaining to biological community structure and habitat usage is limited (Attachment A). During field surveys in fall 2007 and spring 2008, SWCA observed resident euryhaline fish species in the estuary, such as threespine stickleback, Pacific staghorn sculpin, and juvenile starry flounder (*Platichthys stellatus*). Buffalo sculpin (*Enophrys bison*) and unidentified species of larval snailfish (*Liparis* spp.) were also present (see Table 3-2).

Juvenile starry flounder, common in shallow water marine and estuarine areas of the Pacific Northwest (Mecklenburg et al. 2002; Wydoski and Whitney 2003), were abundant in the estuary during both September 2007 and June 2008 fieldwork. Individuals documented in September 2007 ranged in size from 1 to 2.6 inches, lengths which are within the growth range of 0.5 to 1 year old starry flounder in Oregon (Wydoski and Whitney 2003). Climatic conditions in south-central Alaska may slow growth rates; therefore, fish collected in the Buskin River estuary may be older than fish of the same size in warmer environments (Lagler et al. 1962). Starry flounder collected in June 2008 ranged in size from 1.8 to 7.5 inches, approximately the size range of 0.5 to 2 year old starry flounder in Oregon (Wydoski and Whitney 2003).

The six species of anadromous salmonids described above must pass through the estuary during both juvenile and adult migration, and thus are likely to have a seasonal presence in the estuary (see Table 3-1). Additionally, the ranges of two species of anadromous smelt and two species of lamprey include the Kodiak Island area (Mecklenburg et al. 2002), and these species may use the Buskin River estuary: rainbow smelt (*Osmerus mordax*), eulachon (*Thaleichthys pacificus*), Pacific lamprey (*Lampetra tridentata*), and Arctic lamprey (*Lampetra camtschatica*).

Some nearshore marine fishes may also use the estuary on a limited seasonal basis, such as surf smelt (*Hypomesus pretiosus*), Pacific cod (*Gadus macrocephalus*), and sand sole (*Psettichthys melanostictus*) (Mecklenberg et. al. 2002; NMFS 2005). Dungeness crab (*Cancer magister*), collected from the marine side of the Buskin River barrier bar, is also an estuarine species, however, the use of the Buskin River estuary by this species has not been documented (see Attachment A).

In June 2008, juvenile coho were the most numerous species captured at both high and low tide in the backwater area and in isolated wetland pools (see Figure 3-6) that formed during low tide. Coho ranged in size from 1.3 to 3.4 inches, with a mean of 1.7 inches, but the majority were in the range of 1.4 to 1.9 inches. Juvenile sockeye salmon were also captured in the southern backwater area during both high and low tide surveys. They ranged in size from 0.8 to 2.0

inches with an average of 1.6 inches. Sockeye were not captured in the isolated wetland pools. Juvenile chum salmon were captured in the southern backwater area and were more numerous during the high tide survey. Sizes ranged from 1.3 to 2.1 inches, with an average of 1.7 inches. A few chum, ranging from 1.3 to 2.6 inches, were captured in the wetland pools. Steelhead/rainbow trout fry (1.3 to 1.6 inches) were captured in the wetland pools but not in the southern backwater area. During fish collection in the estuary, very small salmonids were observed escaping through the mesh in the sampling gear; species identifications were not possible. This occurrence was more prevalent while sampling the isolated wetland pools, indicating that the area is used as a nursery for very young juvenile salmonids. Size ranges for documented salmonids indicate that all fish were less than one year old (Groot and Margolis 2003). This suggests that juvenile salmonids may use the lower Buskin River and estuary as rearing and foraging grounds.

Aquatic invertebrates in the estuary were sampled in June 2008 with drift nets. Various species were collected (Table 3-3), including some that are known to serve as prey for juvenile salmonids (Quinn 2005). The majority of species were collected in the upper estuary, where salinity influence is minor. Only amphipods and one caddisfly were collected in drift nets near the river mouth.

Table 3-3. Aquatic Invertebrates Collected in the Airport Study Area, June 2008

Common Name	Class	Order	Location	
			Buskin River Estuary	Devils Creek
water mites	Arachnida	Acari	*[1]	*
snails	Gastropoda	unknown	*[1]	
leeches	Hirudinea (subclass)	unknown	*[1]	
water beetles	Insecta	Coleoptera	*[1]	*
mayflies	Insecta	Ephemeroptera	*[1]	*
stoneflies	Insecta	Plecoptera	*[1]	*
caddisflies	Insecta	Tricoptera	*	*
true flies	Insecta	Diptera	*[1]	*
midges	Insecta	Diptera	*[1]	*
scuds	Malacostraca	Amphipoda	*	
water fleas	Malacostraca	Cladocera	*[1]	
aquatic worms	Oligochaeta (subclass)	unknown	*[1]	*

[1] Limited to upper estuary where salinity influence is minor.

3.3.3 Devils Creek

Only a few species of fish were observed in Devils Creek during 2007 and 2008 field surveys. In September 2007, adult pink salmon, juvenile and adult coho salmon, juvenile and adult Dolly Varden char, and unidentified sculpin species were observed. Adult pink salmon were abundant below the falls and were visibly engaged in spawning activity. A few adult coho were observed in this section of Devils Creek; however, many were observed holding in a large pool in the Buskin River, immediately downstream from the mouth of Devils Creek. It is not known whether these fish were waiting to enter Devils Creek or continue up the Buskin River. Juvenile Dolly Varden was the only fish species identified in Devils Creek during June 2008 surveys.

Though numerous adult pink salmon carcasses were observed throughout the lower section of Devils Creek during the September 2007 field survey, coho and pink salmon were not observed above the waterfall on Devils Creek north of Runway 7/25. This indicates that the falls may be a barrier to upstream movement of steelhead, coho, chum, and pink salmon. Juvenile Dolly Varden were observed throughout the creek, including upstream of the waterfall. Although Dolly Varden excel at ascending falls and chutes, their life history strategies vary, and the collected individuals may have resident or anadromous strategies, or a combination of both.

An aquatic invertebrate survey was conducted in Devils Creek in June 2008. Various species were collected (see Table 3-3), many of which are known to serve as prey items for juvenile salmonids (Quinn 2005).

3.4 Habitat Functions

3.4.1 Buskin River and Devils Creek

The Buskin River and Devils Creek provide habitat for anadromous salmonids spawning and rearing in the Buskin River basin. Timing and use vary by species and lifestage (see Attachment A). Within the lower Buskin River and Devils Creek, alternating pool/riffle habitat offers deeper water in which fish can hold. Gravel areas found at the riffle heads and pool tails are used by spawning salmonids to construct redds (spawning beds). Highly oxygenated gravels are needed for successful salmonid egg development and growth of alevins (newly hatched fish) in the redd.

The lower river is braided through lowland meadow/marsh habitat with dense riparian vegetation that provides organic material to the stream, terrestrial insects (potential prey for juvenile salmonids), and nearshore shade. These conditions create rearing habitat known to be favorable for juvenile salmonids, especially coho salmon. The riparian vegetation also adds to the stability of the riverbank. Large woody debris is not generally present in the lower river; therefore channel diversity is the result of braiding, topographic constraints, and large rocks.

Freshwater and estuarine habitats in the Study Area support a diversity of aquatic invertebrates that constitute a prey base for juvenile salmonids. During June 2008 fieldwork, various prey species were collected, including amphipods (scuds), cladocerans (water fleas), mayflies, stoneflies, caddisflies, true (dipteran) flies, midge flies, and water mites (see Table 3-3).

Although Buskin Lake is outside of the Study Area, it provides spawning and rearing habitat necessary for the native sockeye run that must migrate through the Buskin River and estuary.

3.4.2 Buskin River Estuary

Estuaries are important nursery grounds for many species of both freshwater and marine fish and invertebrates. Estuaries are important habitats for juvenile salmonids during a critical life stage. The environment is highly productive, resulting in an abundance of varied prey items. In addition, the structurally complex habitat provides sheltered hiding spaces for juvenile salmonids. Prior to transferring from a freshwater to saltwater existence, juvenile salmonids must undergo smoltification, an important physiological, morphological, and behavioral change. Smoltification prepares salmonids for life in marine environments and estuaries are an important habitat that may be used by salmonids to ease this transition. The amount of use an estuary receives varies by species. Chum and pink salmon fry migrate downriver soon after emergence; chum often spend time in estuaries whereas pink salmon move quickly through. Coho rear in the river for a year before moving to the ocean, and may use the estuary or other nearby lower river areas for overwintering. Juvenile sockeye salmon rear in freshwater lakes for one to three years before migrating to the ocean and generally move through the estuary rapidly (Quinn 2005).

Adult salmonids also migrate through estuaries to their natal freshwater spawning grounds. They may hold in the estuary, lower Buskin River, or other nearby areas just outside of the Buskin River mouth. Although intertidal spawning has not been documented in the Buskin River estuary, it is not uncommon for pink and chum salmon in Alaska to spawn in the tidally influenced areas (Groot and Margolis 2003).

Data on juvenile residence and estuarine usage for salmonids in the Buskin River estuary are sparse and incomplete. Though there is little refuge in the river channel during low tide, there is a backwater area in the southeast corner of the estuary, and small wetland pools form on the north side of the river as tidal outflow leaves these areas completely or partially isolated. Neither of these parts of the estuary have enough vegetation to provide significant refuge for juvenile salmonids, but, at times, each of these locations has slow currents or still water. While abundant vegetation would provide ***ideal*** refuge conditions for juvenile salmonids, the presence of slow-moving or still water offers some (albeit limited) refuge for these young fish. Juvenile salmonids were observed using both areas during June 2008 surveys and the wetland pool area during September 2007; the backwater area was not surveyed in September 2007. During all surveys at the two locations, juvenile coho were present and were the most numerous salmonid captured. In June 2008, sockeye and chum were captured in the southern backwater area but sockeye were absent from the wetland pools; a few chum were present. Numerous small salmonids were observed in the wetland pools, and very small salmonids were observed escaping through the mesh in the nets. Size ranges for documented salmonids indicate that all fish were less than 1 year old (Groot and Margolis 2003). This size range suggests that juvenile salmonids likely use the lower Buskin River and estuary as rearing and foraging grounds, and coho may overwinter in the estuary or other areas nearby in the lower Buskin River. Further support is provided by the presence of an aquatic invertebrate assemblage in the estuary that is known to serve as a prey base for juvenile salmonids (see **Section 3.3.2, *Biotic Communities and Populations, Buskin River Estuary***).

As discussed under **Section 3.3.2,** juvenile starry flounder were abundant in the estuary during SWCA's fieldwork. Size range for these juveniles indicated that the estuary and marine areas surveyed around the Kodiak Airport are used as nursery grounds by starry flounder.

The tidal marsh vegetation in the Buskin River estuary is a source of organic material that is important to estuarine food webs. It may also be a source of exported organic material to nearshore marine waters. The importance of this exported organic material in nearshore marine food webs has not been quantified for the Buskin River.

4 MARINE ECOLOGY

4.1 Introduction

This discussion of marine ecology focuses on the intertidal and subtidal habitats, biotic communities (namely fish, macroalgae, and marine invertebrates), and habitat functions of the Airport Study Area. Marine mammals and seabirds are discussed separately in SWCA 2009a. St. Paul Harbor, described above in Section 1, extends along the shore from the City of Kodiak south toward Womens Bay (see Figure 1-1) and includes the Airport Study Area (Figure 1-2). The Buskin River enters St. Paul Harbor adjacent to the north edge of the Airport.

Wave exposure drives major physical processes, such as sediment drift, in coastal habitats and controls biotic assemblages in intertidal and nearshore zones. The Alaska ShoreZone Project is a coastal habitat mapping and classification system specializing in the collection and interpretation of spatially referenced aerial imagery of the intertidal and nearshore environments (NOAA 2008b). The Alaska ShoreZone project mapped wave exposure and classified habitats throughout Kodiak Island in 2002 and 2005. Wave exposure categories along the Airport Study Area are predominantly considered “semiprotected.” A small boat basin, located between Runway ends 29 and 36, is flanked by armored breakwaters and considered “protected.” ShoreZone habitat classifications within the Study Areas include the following habitat types: semiprotected shore with immobile/partially mobile substrate; protected and very protected shore with immobile/partially mobile substrate; estuary; anthropogenic (human-made) features; and mobile substrates (bare beach).

Tidal range in Chiniak Bay is approximately 8.2 feet. In the Airport area, a broad sandy zone extends east from the Buskin River barrier bar and from the river mouth as an alluvial fan. A steeper, rocky area extends south from the base of Runway end 25 toward Womens Bay, and a semi-protected beach (known locally as Jewel Beach) is at the southern extent of the Airport south of Runway end 36 (see Figure 1-2). The subtidal area, with water depths of 30 feet and less, extends away from shore near the Airport and south into Womens Bay.

4.2 Habitat Characteristics

Dive/walk surveys were conducted in the following areas from March to May 2008, and November 2008: the Buskin River barrier bar, near the base of Runway end 18; the base of Runway end 25; the area between the bases of Runway ends 25 and 29; and Jewel Beach, near the base of Runway end 36. Results of habitat surveys to target freshwater and estuarine portions of the Study Area are discussed in **Section 3.2, *Freshwater Ecology, Habitat Characteristics***. Substrate composition, mobile and sessile invertebrate fauna, fish, and algal presence were recorded during the surveys. Most of the survey transects extended from the intertidal area to the subtidal area. Flora and fauna identified during these surveys are presented in **Section 4.3.1, *Biotic Communities and Populations, Intertidal***. Field methods are detailed in **Section 2**.

4.2.1 Approach to Habitat Characterization

Habitats in the Airport Study Area were characterized using a three-tier habitat classification system based on depth, substrate, and salinity (freshwater influx). Tidal data were used to map depths (VAI 2008a). Depths between MHHW (9.53 feet) and MLLW (0.76 feet) were considered intertidal and areas below MLLW were considered subtidal. Areas upstream of the Buskin River mouth were considered tidally influenced riverine habitats and are discussed in **Section 3, *Freshwater Ecology***. Dominant substrates and algal cover in the marine portion of the Study Area were modeled (Figure 4-1 and Figure 4-2) using data from 2008 intertidal and subtidal habitat surveys and the 2008 water resources report (VAI 2008a). Modeling methods used to develop habitat maps are included in **Section 2**, ***Methods***. Based on freshwater discharge modeling (CEDS-I 2008), all sample sites on the marine side of the Buskin River mouth were considered freshwater-influenced marine habitats.

4.2.1.1 Depth

The intertidal zone is classified as the area between MHHW and MLLW. Organisms found within this dynamic habitat are subject to many extremes, including temperature, light, wave exposure, and hydration levels, as tidal fluctuations produce conditions ranging from complete underwater submersion to complete exposure to the air. Thus, organisms found within this zone must be capable of withstanding these extremes or moving in response to changing conditions.

The subtidal zone, located below MLLW, is nearly always submerged underwater, except for during extreme low tides. Because this habitat is not subjected to the tidally influenced extremes present in the intertidal zone, the subtidal zone tends to be more stable than the intertidal zone and a diverse assemblage of organisms may be found there.

4.2.1.2 Substrate

Transported sediments accumulate to form the barrier bar and offshore shoals in the area of the Buskin River mouth. Broad intertidal and shallow subtidal areas are found north and south of the Buskin River mouth. Sources of the barrier bar sediments are likely direct transport of the former delta south of the river mouth, and river substrates that were initially deposited offshore and eventually incorporated into the longshore transport system before becoming redeposited at the bar (CEDS-I 2008). Specifics on the quantity of sediments contributed from each of these sources and processes involved in formation of the bar are unknown.

Sand is the predominant intertidal and subtidal substrate around the Airport, but there are some areas of gravels, cobbles, boulders, and bedrock (CEDS-I 2008). This bedrock is either slate or shale (Combellick 1989), both of which tend to break along flat cleavage lines. Although the bedrock is somewhat weak and breaks easily during storm events, it does provide suitable substrate for attachment by macroalgae and sessile marine invertebrates. Sand and gravel are mobile substrates and therefore unsuitable for most sessile invertebrates and long-lived algae.

4.2.1.3 Freshwater Influx: Buskin River Influence on Marine Habitats

Outflow from the Buskin River influences habitat characteristics of the intertidal and subtidal marine environments near the Buskin River mouth, including chemical and physical characteristics. The Buskin River and estuary may transport organic material (plant detritus and dissolved organics) from upstream habitats to these marine environments; however, water quality, flow, and organic load data from the Buskin River were not found by the study team.

Habitats in this area are predominantly freshwater-influenced intertidal and subtidal zones. Modeling of river discharge (CEDS-I 2008) indicates that a freshwater plume sweeps north and south daily from the river mouth hugging the shore. The plume width (east-west axis) is typically around 0.7 km, but at times extends as far as 1.94 km off shore or shrinks to 0.14 km from shore. Flow direction of the freshwater plume is primarily influenced by winds. Depending on wind conditions, the freshwater plume can extend as far south as Jewel Beach and as far north as Gibson Cove. Thus, the entire Study Area receives some freshwater influence in at least the upper water column on a daily or weekly basis, depending on prevailing winds. Jewel Beach appears to receive less frequent and less concentrated freshwater flushing than areas closer to the Buskin River mouth. Modeling of water residence time in Chiniak Bay indicates that residence times in the Study Area can range from 0 to 12 days depending on winds (CEDS-I 2008). These observed and modeled data suggest that the Study Area has ecological mechanisms (salinity gradients, sediment and nutrient transport, etc.) to create estuarine conditions outside the Buskin River barrier bar. However, because the area is not enclosed, conditions are perhaps more dynamic than within a typical (enclosed) estuary system. The eastern shore of the barrier bar, which is likely the ecotone between marine and freshwater habitats, supported the greatest species diversity of the areas sampled for fish in 2007 and 2008.

Limited temperature, salinity, pH, and dissolved oxygen data were collected by SWCA during marine and estuarine surveys in September 2007 and June 2008. These data demonstrate the influence of Buskin River flow on water temperature and salinity in intertidal and nearshore areas, providing evidence of water column stratification at sample sites near the Buskin River mouth and east of the barrier bar (Table 4-1). In these areas, a freshwater lens was documented in the upper water column when the lower water column was mesohaline (5–18 ppt) to polyhaline (18–30 ppt). This suggests that during periods of low wave activity, mixing in the Airport Study Area is slow, even in shallow intertidal areas. Thus, a variety of biotic communities may use different stratified layers of the water column, and there may be two or more fish communities within a single vertical area. For example, juvenile salmonids may only use the uppermost water layer that is affected by the freshwater plume, while juvenile walleye pollock may use only the lower saltier layers at the same location. Other characteristics, such as light, nutrients, and exposure to predation, may further contribute to stratification of fish assemblages in different levels of the water column.

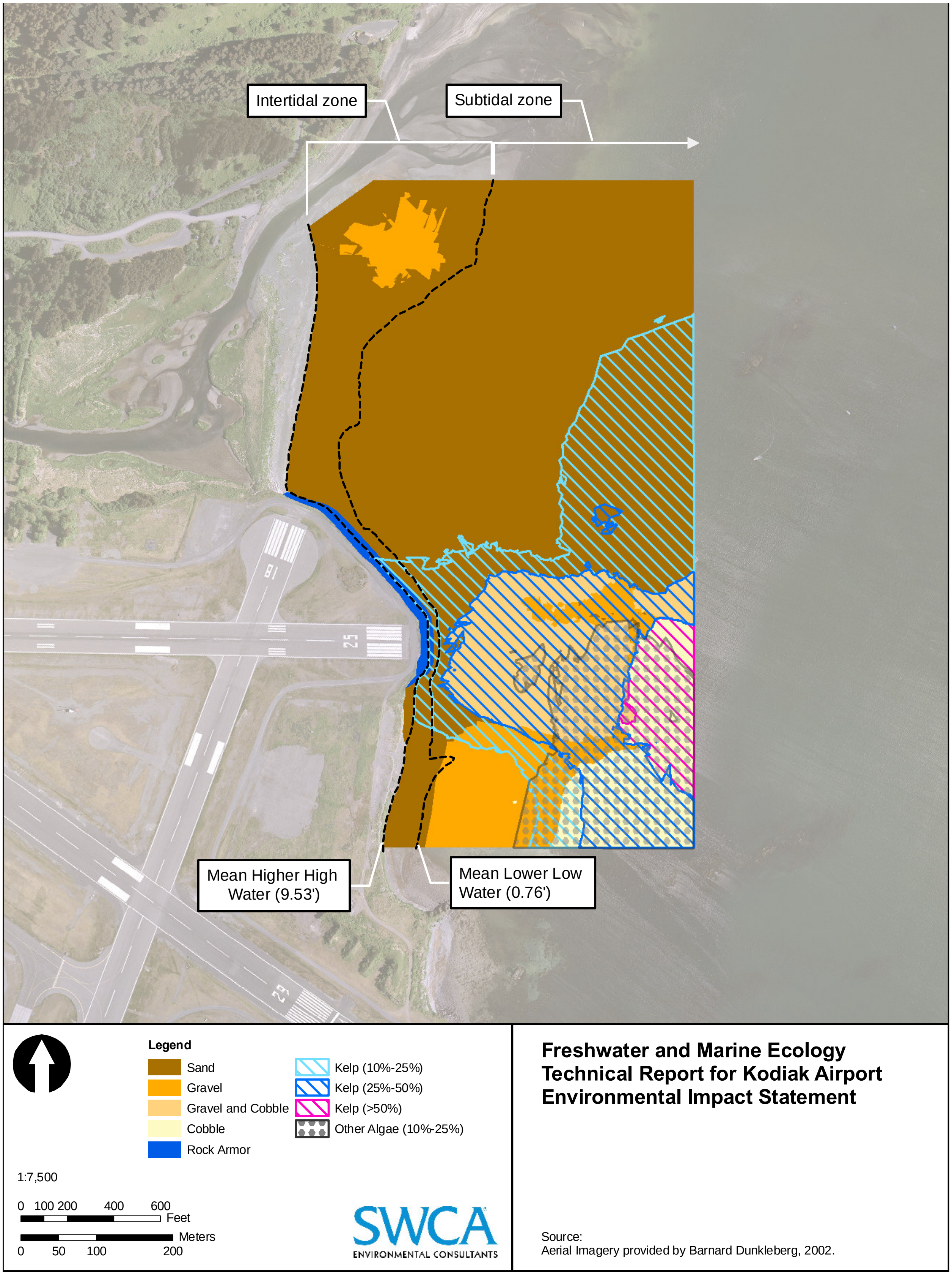

Figure 4-1. Dominant substrates and algal presence in northern marine portion of Airport Study Area.

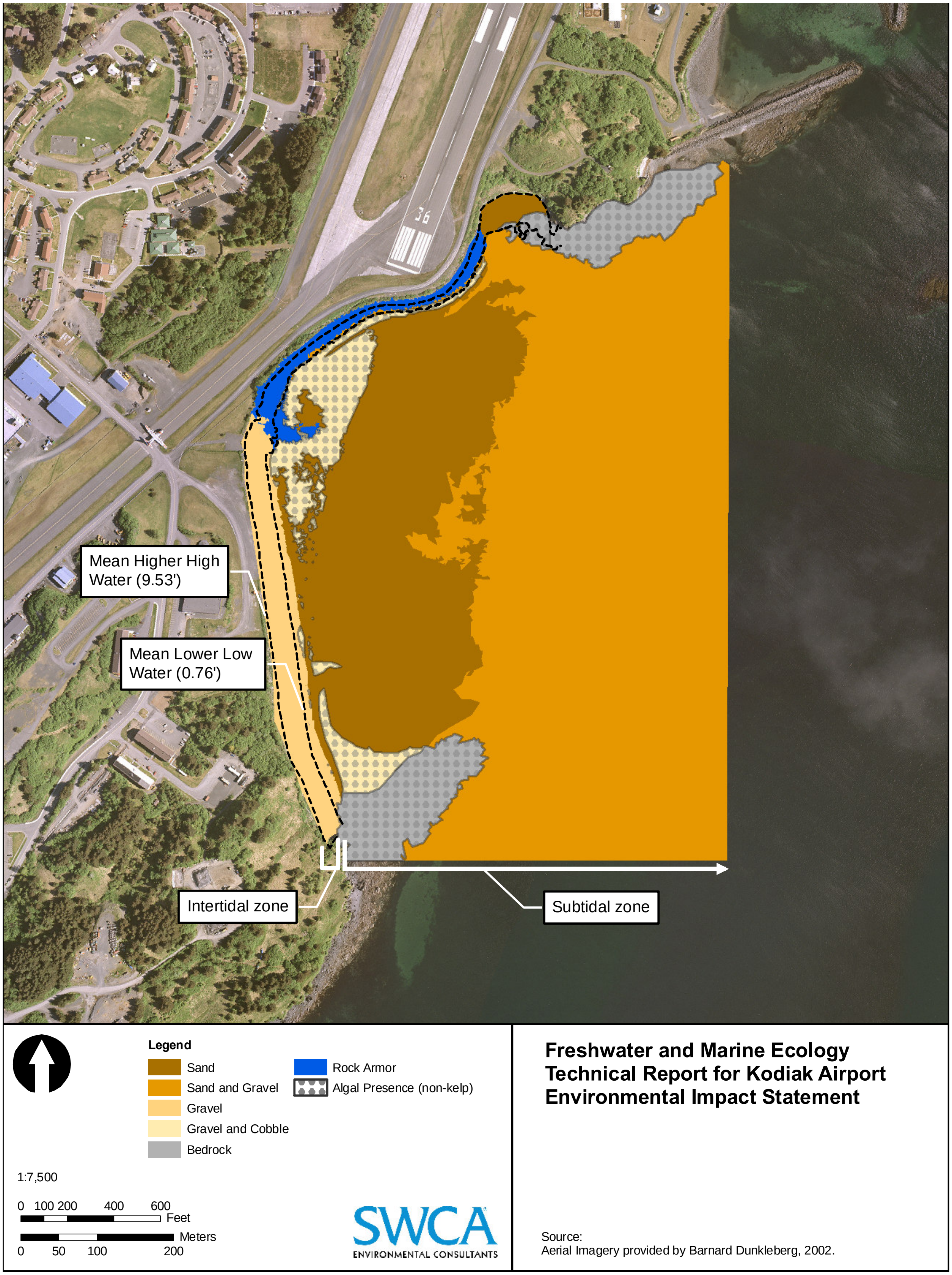

Figure 4-2. Dominant substrates and algal presence in southern marine portion of Airport Study Area.

Table 4-1. Temperature and Salinity Data Collected by SWCA, 2008

Date	Time (hours)	Location	Wind Direction (origin)	Tidal Stage	Water Depth (feet)	Temperature (° Celsius)	Salinity (ppt)
June 19	1143	Buskin River mouth	280–300º	Low	0	7.65	8.36
					1	7.74	25.87
					2	7.82	26.99
					3 (bottom)	7.88	29.59
June 19	1609	Runway end 18	320º	High	0	10.48	7.86
					1	10.44	13.09
					2	10.00	24.45
					3 (bottom)	9.57	26.70
June 20	1058	Approximately 200 feet east of Runway end 18	310º	Low	0	8.48	8.28
					1	8.5	9.29
					2 (bottom)	8.52	27.41

4.2.2 Intertidal Habitat Characterization

4.2.2.1 Buskin River Barrier Bar at Base of Runway End 18

River outflow, sediment load, and longshore current direction have created a barrier bar and nearshore shoals near the mouth of the river and Runway end 18 (CEDS-I 2008). The barrier bar presently directs the Buskin River northward (away from Runway end 18) to its mouth approximately 1,500 feet north of the runway end. In its present configuration, the barrier bar may be unstable due to hydraulic conditions of the river imposed by the length of the barrier bar. River breakouts may occur under certain conditions; however, the frequency of the river breaching the bar is unknown. Both high river levels (to saturate the soil) and a big storm surge (to push through the bar) would be required. The likelihood of a breach through the barrier bar is small due to the high level of efficiency in the channel; that is, the difference between the 100-year flood line and MHHW is small (CEDS-I 2008).

The intertidal area of the barrier bar is bounded on the south by rock armoring at Runway ends 18 and 25. The upper extent of the beach is bounded by salt grasses and plants of the Buskin River barrier bar, which is strewn with driftwood and debris. The high tide line is marked by decomposing kelp and algal drift, which provide food and shelter for crustacean beach hoppers (family Talitridae). Depending on storm activity, the amount of algal drift can be substantial as offshore kelp is torn from holdfasts and deposited on shore.

The intertidal area of the Buskin River barrier bar is a low-gradient, sand beach with gravels and some offshore shoals of finer sediment. Lower down the beach, cobbles and large gravels are strewn in a band over the surface. There is a delta-shaped deposit of material in the nearshore area located north and east of Runway end 18. This material represents deposition prior to northward displacement of the river by Airport expansion (CEDS-I 2008). Materials from the former delta are continuous with the current delta. Of the three areas surveyed, this area is exposed to the greatest amount of freshwater and silt from the Buskin River plume.

The only human-made structures on the intertidal slope of the Buskin River barrier bar are a concrete vault (Figure 4-3) near the northern portion of the barrier bar and two airplane wings (Figure 4-4) near Runway ends 18 and 25. The concrete vault remains from World War II and was presumably used to house instrumentation. The surface of the vault is eroding and covered by acorn barnacles (*Balanus glandula*); much of the interior is filled with sediment. The airplane wings are also heavily eroded and partially covered with sediment. The surface of the exposed framework of the wing interior is covered with rockweed (*Fucus gardneri*), Pacific blue mussels (*Mytilus trossulus*), and acorn barnacles. It is unknown whether the airplane wings are the remains of an accident or abandoned parts.

Figure 4-3. Concrete vault on the intertidal slope of northern portion of the Buskin River barrier bar.

Figure 4-4. Airplane wing on the intertidal slope of the Buskin River barrier bar near Runway ends 18 and 25.

4.2.2.2 Rocky Shore at Base of Runway End 25

The lowest level of rock armor on the embankment at the base of Runway end 25 ends abruptly at a narrow, semi-protected, rocky intertidal area. The lowest rocks on the bank are barely accessible to the highest intertidal organisms, which at the time of the survey in May 2008 were primarily young barnacle spat. The area below the rock armored bank has a gentle slope similar to the Buskin River barrier bar and is predominantly sand.

Modeling of freshwater discharge indicates that the area is frequently flushed with freshwater. The effects of freshwater and sediment from the Buskin River plume appear to be less than along the barrier bar and a greater diversity of marine organisms was observed.

Intertidal sampling efforts were minimal at the base of Runway end 25 due to the narrow band of habitat visible during low tide. Instead, the field crew walked the base of the rock armor embankment and completed a visual survey of substrate, algae, and marine invertebrates.

4.2.2.3 Rocky Shore between Bases of Runway Ends 25 and 29

A beach extends between the rock armor on the embankment at the base of Runway end 25 and Runway end 29. Similar to the barrier bar, salt grasses and terrestrial plants mark the upper extent of the beach with driftwood and debris spread about. Decomposing kelp and algal drift mark the high tide line, and based on storm activity, this material may be substantial. The upper beach near the high tide line is sandy, with small amounts of gravel and shell, and slopes gently toward the bay. There is an abrupt transition to cobble and gravel substrate as the beach slope changes to a broad, flat shelf. The gravel and cobbles at this level are worn, rounded, and nearly devoid of biota, indicating substrate mobility from wave activity. Lower down the beach, the majority of the largest cobbles are covered with mature acorn barnacles, thatched barnacles (*Semibalanus cariosus*), and occasional clumps of rockweed.

Modeling of freshwater discharge indicates that the area is frequently flushed with freshwater on a daily or weekly basis, depending on wind conditions. The effects of freshwater and sediment from the Buskin River plume appear to be less at this location than along the barrier bar.

4.2.2.4 Jewel Beach at Base of Runway End 36

The area at the base of Runway end 36 is a semi-protected cove, known locally as Jewel Beach due to an abundance of beach glass. The intertidal area on the far north end of the beach is extremely steep, and the substrate is composed of large slate boulders. In this area, there is also rock armor that extends from the base of the runway into the water. South of the rock armor, the area is marked by large steel pilings surrounded by scrap metal, including large machine parts, brass, and old copper wiring embedded in weathered concrete. Immediately adjacent to the metal debris is an old storm drain outfall pipe. The upper beach in this area is covered with large gravel and chunks of concrete that wash out of the bank above. The substrate transitions from the large rock armor boulders to gravel, then sand and fine gravel as the beach progresses to the south. Although the main beach is relatively well protected, there is little evidence of algae beyond the rock-armored slope, indicating that substrates at the beach are mobile. At the furthest southern point of the beach, a rocky intertidal point extends out into the bay. The majority of this point is exposed only during extreme low tide, with only a small portion remaining dry during all tidal cycles. The rocks are covered with dense areas of rockweed, and patches of acorn barnacles and Pacific blue mussels.

Modeling of freshwater discharge indicates that this area is flushed with freshwater daily or weekly depending on wind conditions. The models indicate that Jewel Beach receives less frequent and less concentrated freshwater flushing than areas closer to the Buskin River mouth, and thus may have higher salinities.

4.2.3 Subtidal Habitat Characterization

4.2.3.1 Buskin River Barrier Bar at Base of Runway End 18

The subtidal area adjacent to the bar continues from the intertidal area as a flat sandy area, gently sloping towards the bay. Bottom substrates are composed primarily of sand; however there are patches of algal drift that have settled into slight depressions on the bottom. Small clumps and single stipes of brown algae (kelp) were also observed. They are likely attached, by their algal holdfast, to larger substrates such as cobble. These rocks may have moved to their current location during storm events and subsequently become covered with sand. The individual kelp and clumps identified in this area are probably temporary features; the algae will likely die when the holdfast and growth center above the holdfast become completely buried in sand.

4.2.3.2 Rocky Shore at Base of Runway End 25

Beyond the base of the rock armor at Runway end 25, the narrow sandy intertidal area becomes a flat and rocky subtidal area with predominant bottom substrates composed of sand interspersed with patches of kelp, primarily ribbon kelp (***Alaria marginata***). This area transitions into a kelp bed, with predominant bottom surface substrates of small gravels and cobbles. There are possibly deeper layers of large boulders or bedrock; however, without extensive excavation it was not possible to determine more than the overlying surface material. The rock substrate is more stable and suitable for colonization by sessile invertebrates and algae, as indicated by the presence of slow-growing pink crustose coralline algae (***Lithothamnion phymatodeum***).

SWCA's field observations are consistent with the results of an experimental marine habitat mapping project conducted by NOAA. This project used echosounders and towed underwater video cameras off Runway end 25 in water depths ranging from 20 to 39 feet (Urban n.d.) Three sampling drifts were made roughly parallel to shore. Bottom cover of macroalgae ranged from 0% (bare substrates) to 100%. The most common macroalgae identified were shotgun kelp (***Agarum clathratum***), dragon kelp (***Alaria fistulosa***), witch's hair (***Desmarestia aculeata***), occasional bull kelp (***Nereocystis leutkeana***), and unidentified species of kelp (***Laminaria*** sp.). Numerous jellyfish (possibly ***Polyorchis penicillatus***, kelp greenling (***Hexagrammos decagrammus***), and juvenile Pacific cod were noted on the video tapes (Urban n.d.)

4.2.3.3 Rocky Shore between Bases of Runway Ends 25 and 29

The shallow subtidal substrates in this area are composed of cobbles, large gravels, and shell debris. Much of the larger substrate is covered by crustose coralline algae, indicating stability of the bottom surface. The inshore area is richly covered with annual brown, red, and green algae, most notably a thick overstory of ribbon kelp and wireweed (***Sargassum muticum***). Further from shore, the dominant species composition changes from annual macroalgae to the perennial split kelp (***Laminaria bongardiana***). From the boat, small patches of bull kelp were observed scattered throughout the area. However, neither adult bull kelp nor juveniles were encountered during the subtidal surveys. Benthic macroinvertebrates found in this area include black leather chiton (*Katharina tunicata*), lined chiton (*Tonicella lineata*), painted anemone (*Urticina grebelnyi*), and periwinkle snails (*Littorina* spp).

4.2.3.4 Jewel Beach at Base of Runway End 36

The Jewel Beach area is a semi-protected cove. The area south of the base of the rock armor bank is composed almost entirely of sand. During surveys in 2008, two small clumps of the brown algae witch's hair were observed in this area. This alga appeared to be established, with holdfasts attached to a single large cobble that was partially submerged in the sand. Large drifts of algal detritus were also observed in this area. Substrates east of the base of Runway end 36 are mostly sand. One small kelp bed was encountered; substrates within the kelp area consist of cobbles and sand.

4.3 Biotic Communities and Populations

In waters around the island of Kodiak, and within approximately 250 miles from the City of Kodiak, over 750 invertebrate and macroalgal species have been recorded by the Kodiak NMFS staff (Stevens 2008). Many organisms on this list are found in the seamounts 250 miles from Kodiak and are not applicable to the Airport Study Area. However, even without those species, the list, particularly when fish are included, is much longer than could be reasonably discussed in this report. To complicate matters, many organisms inhabit the open bay, subtidal, and intertidal zones during different life stages, or have a broad range within these habitats. For purposes of clarity this discussion will include only the dominant fish, invertebrates, and algae of the habitats found near the Airport, including specific findings from surveys conducted in the intertidal and subtidal zones of the Airport Study Area. Marine mammals and seabirds are discussed separately in SWCA 2009a.

Chiniak Bay intertidal and subtidal habitats are used by a variety of fish species and marine invertebrates during different life stages. Commercial fisheries provide evidence of the following fishes and invertebrates. Fish species caught in Chiniak Bay include Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon, coho salmon, pink salmon, sockeye salmon, Pacific herring (*Clupea pallasii*), eulachon, Pacific cod, walleye pollock (*Theragra chalcogramma*), arrowtooth flounder (*Atheresthes stomias*), Pacific halibut (*Hippoglossus stenolepis*), sculpin (family Cottidae), spiny dogfish shark (*Squalus acanthias*), flathead sole (*Hippoglossoides elassodon*), rock sole (*Lepidopsetta* spp.), skates (family Rajidae) (Foy 2005a), lingcod (*Ophiodon elongatus*) (Stock and Meyer 2005), black rockfish (*Sebastes melanops*) (NMFS 2008a), and yelloweye rockfish (*Sebastes ruberrimus*) (Meyer 2000). Shellfish and other invertebrates found in Chiniak Bay include Dungeness crab, Tanner crab (*Chionoecetes bairdi*), and red king crab (*Paralithodes camtschaticus*) (NMFS 2008b), as well as Pacific giant octopus (*Enteroctopus dofleini*) and sea cucumber (class Holothuroidea) (Stevens et al. 2000).

Chiniak Bay is used by a variety of fish, and marine invertebrates during some or all of their life stages. Marine fishes that may be found in nearshore habitats of the Study Area include the smelt species capelin (*Mallotus villosus*), surf smelt, eulachon, and rainbow smelt; Pacific herring; numerous sculpin species (family Cottidae); snailfish species (family Liparidae); poacher species (family Agonidae); Pacific sandfish (*Trichodon trichodon*); and numerous flatfish species, including starry flounder, butter sole (*Isopsetta isolepis*), rock sole, and sand sole. Marine invertebrates common to nearshore Kodiak waters include crustaceans (copepods, euphausiids, crangons, mysids, amphipods, isopods, and gammarids), arrow worms (phylum Chaetognatha), bivalves, gastropods, jellyfish (phylum Cnidaria), and annelids.

4.3.1 Intertidal

Intertidal areas are typically used by many species of fish, including smelt, greenling (*Hexagrammos* sp.), sculpin, and prickleback (class Actinopterygii), as well as pink and chum salmon; with the exception of greenling and prickleback, these species were identified during beach seine surveys in 2007 and 2008 (see Table 4-1 and Table 4-2). For these surveys, each beach seine was pulled through the entire intertidal area and a portion of the adjacent subtidal area. Because it is not possible to differentiate whether fish were captured from intertidal or subtidal areas, all fish captured during the aforementioned beach seines are presented together in this discussion on intertidal biota.

Table 4-2. Invertebrates Collected during 2008 Seine Surveys in the Marine Intertidal Area along the Barrier Bar and Beach North of the Buskin River Mouth

Scientific Name	Common Name
order Amphipoda	amphipod, sand flea
Cancer magister	Dungeness crab
phylum Cnidaria	jellyfish
Crangon sp.	crangonid shrimp
order Euphausiacea	euphausiid, krill
Pagurus sp.	hermit crab

Pacific sand lance (*Ammodytes hexapterus*), an important forage fish, were captured from the small beach north of the Buskin River mouth during this study and other studies (S. Payne, NMFS, personal communication, January 29, 2008). In June 2008, they were captured at various locations along the marine side of the Buskin River barrier bar. A small school of sand lance was also sighted in the shallow waters off Jewel Beach during subtidal surveys in May 2008. This species exhibits high spawning site fidelity and uses fine gravel and sand beaches, shallow banks, and bars in the intertidal zone to rest, hide, and spawn (Robards et al. 1999).

Four sculpin species were identified during SWCA's surveys in 2007 and 2008: Pacific staghorn sculpin, great sculpin (*Myoxocephalus polyacanthocephalus*), tidepool sculpin (*Oligocottus maculosus*), and buffalo sculpin. These species may use the intertidal zone for spawning, rearing, and foraging (NMFS 2005).

Juvenile coho, chum, and pink salmon, as well as juvenile and adult Dolly Varden, were documented in the intertidal zone in 2008. Juvenile chum and pink salmon were the most prevalent salmonids identified during the nearshore surveys of the marine side of the barrier bar and beaches north of the river mouth. Chum salmon were substantially more common than pink salmon; however, pink salmon were more numerous in the southern-most locations sampled on the barrier bar. Surveys occurred during both high and low tide. In one low tide survey, a very large quantity of juvenile salmonids was collected. Due to the large numbers and the goal of avoiding sampling mortalities of juvenile salmon, the majority of fish were only identified to genus; however, of the fish identified to species, pink salmon outnumbered chum salmon.

Juvenile and adult starry flounder are common on the marine side of the barrier bar and were documented during both the May 2008 transect survey and the June 2008 beach seine survey. Other species identified in June 2008 beach seine surveys on the marine side of the barrier bar included rock sole, and butter sole; juvenile sand sole; tubenose poacher (*Pallasina barbata*), sturgeon poacher (*Podothecus accipenserinus*); threespine stickleback; walleye pollock, Pacific tomcod (*Microgadus proximus*); Pacific sandfish; and spotted snailfish (*Liparis callyodon*).

Four species of smelt—eulachon, capelin, rainbow smelt, and surf smelt—may use lower Buskin River and intertidal marine beach habitat for spawning. Only one juvenile surf smelt was observed during June 2008 field surveys; the other smelt species were not observed during 2007 or 2008 field surveys. The distribution range of these species includes Kodiak Island and the Airport area (Mecklenburg et al. 2002).

Although not targeted during these surveys, some macroinvertebrates were collected during 2008 beach seines along the barrier bar and beach north of the Buskin River mouth (see Table 4-2). Several species of marine invertebrates and algae were also documented during 2008 intertidal and subtidal transect surveys (Table 4-3). Benthic marine invertebrates common to the intertidal area of Kodiak Island include copepods, euphausiids, mysids, amphipods, isopods, gammarids, chaetognaths, crustaceans, bivalves, gastropods, annelids, and polychaetes.

Bivalves are common in the intertidal zone and nearshore waters of the Airport area, particularly off the barrier bar where numerous clam siphon holes were noted. Investigation of the shell windrows on the upper beach in December 2007 revealed approximately 98% butter clams (*Saxidomus giganteus*), 1% cockles (*Clinocardium spp.*), and trace amounts of horse clams (*Tresus capax*). Beds of razor clams (*Siliqua patula*) have been identified from the intertidal and shallow subtidal areas near the mouth of the Buskin River (NOAA 1997); however, evidence of razor clam presence was not noted by the field crew. The littleneck clam (*Protothaca staminea*), which is anecdotally known to use the area, was also not observed during these surveys.

Table 4-3. Algae and Invertebrates Identified during Intertidal and Subtidal Transect Surveys in the Airport Study Area, March–May 2008

Scientific Name	Common Name	Location				
		Barrier Bar	Runway end 25	Runway end 36 (Jewel Beach)	Human-made Structure	Between Runway ends 25 and 29
Algae:						
Brown Algae						
Alaria marginata	ribbon kelp		*	*		*
Desmarestia aculeata	witch's hair			*		

Table 4-3 (continued). Algae and Invertebrates Identified during Intertidal and Subtidal Transect Surveys in the Airport Study Area, March–May 2008

Scientific Name	Common Name	Location: Barrier Bar	Location: Runway end 25	Location: Runway end 36 (Jewel Beach)	Location: Human-made Structure	Location: Between Runway ends 25 and 29
Brown Algae (continued)						
Fucus gardneri	rockweed			*	*[1]	*
Laminaria bongardiana	split kelp		*	*		*
Sargassum muticum	wireweed					*
class Phaeophyceae (unidentified sp.)	filamentous brown algae			*		
Green Algae						
phylum Chlorophyta (unidentified sp.)	filamentous green algae	*	*	*		
Ulva fenestrata	sea lettuce		*			*
Red Algae						
Bossiella spp.	geniculate coralline algae			*		
Lithothamnion phymatodeum	coralline crust		*	*		*
Neorhodomela larix	black pine			*		*
Opuntiella californica	red opuntia			*		*
Palmaria callophylloides	frilly red ribbon		*	*		*
Palmaria hecatensis	stiff red ribbon		*			*
Palmaria mollis	red ribbon		*	*		*
Sponge:						
Halichondria panicea	yellow-green encrusting sponge					*
Molluscs:						
Katharina tunicata	black leather chiton		*	*		*
Leptasterias spp.	sea star			*		
Littorina spp.	periwinkle snail		*	*		*
Mytilus trossulus	Pacific blue mussel			*	*[1]	
Searlesia dira	dire whelk					*
Tectura persona	mask limpet					*
Tectura scutum	plate limpet					*
Tonicella lineata	lined chiton					*
Volutharpa ampullacea	big-mouth whelk			*		
class Gastropoda, order Patellogastropoda	limpet (unidentified sp.)			*		*
Cnidarians:						
Urticina grebelnyi	Painted anemone					*
Crustaceans:						
Balanus glandula	acorn barnacle		*	*	*[1,2]	*
Pagurus sp.	hermit crab	*				

[1] = airplane wing
[2] = vault

4.3.2 Subtidal

Midwater and benthic fish populations in Chiniak and Marmot Bay have been documented extensively in the Gulf Apex Predator-prey (GAP) study (Foy 2005a). This study examined seasonal distributions of fish species around Long Island (near the northeast corner of Kodiak Island) from 2000 to 2003 using midwater and bottom trawls. Management information from the numerous commercial and subsistence fisheries near Chiniak Bay (Brown et al. 2001) was also used to describe Chiniak Bay fish populations. A detailed discussion on fisheries is provided in SWCA 2009b. Several species of fish were caught in midwater trawls during the Marmot Bay and Chiniak Bay GAP surveys (Table 4-4); however, walleye pollock was the dominant species (Foy 2005b).

Table 4-4. Species Composition in Marmot and Chiniak Bays in 2002, Expressed as Percent of Nearshore Pelagic Fish and Invertebrate Catch

		Month				
Scientific name	Common name	May	June	July	August	September
Theragra chalcogramma	Walleye pollock	99.9	79.1	90.8	68.6	95.7
Mallotus villosus	Capelin	<0.1	1.1	0.7	29.1	0.5
Thaleichthys pacificus	Eulachon	0.1	16.6	3.8	0.4	2.0
Pandalopsis dispar	Sidestripe shrimp		0.7	3.8		
Pandalus borealis	Pink shrimp		1.0	0.3		
Liparididae	Snailfishes		0.4			
Cnidaria	Jellyfish				1.0	0.9
Trichodon trichodon	Pacific sandfish		<0.1	<0.1	0.4	0.5
Hippoglossoides elassodon	Flathead sole		0.3	0.1		
Clupea pallasi	Pacific herring				0.2	0.1
Berryteuthis magister	Majestic squid		0.2	0.1		0.1
Unidentified larval fish	Unidentified larval fish		<0.1		0.2	
Psychrolutes sigalutes	Soft sculpin				0.1	0.1
Gadus macrocephalus	Pacific cod	<0.1	0.2	0.1	<0.1	0.2
Atherestes stomias	Arrowtooth flounder		0.1	0.1		
Mysidacea	Mysidacea	<0.1		0.1		
Lycodes brevipes	Shortfin eelpout		<0.1			
Sebastes aleutianus	Rougheye rockfish		<0.1			
Liparis gibbus	Variagated snailfish				<0.1	
Podothecus acipenserinus	Sturgeon poacher				<0.1	
Lamna ditropis	Salmon shark				<0.1	<0.1
Sebastes alutus	Pacific ocean perch			<0.1		
Aptocyclus ventricosus	Smooth lumpsucker			<0.1		<0.1
Euphausiacea	Euphausiacea		<0.1		<0.1	<0.1

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Mueter and Norcross (1999) sampled fishes at 211 sites around Kodiak Island in 1991 and 1992, including Chiniak Bay, using bottom trawl gear. Of the 75 species of bottom fishes identified in the study, the most abundant were rock sole (33%), flathead sole (8.3%) and Pacific cod (7.0%). Sediment grain size data were also collected at the trawl sites, and mixed substrates had higher species richness than pure sediments. Fish catch per unit effort (CPUE) tended to be lower on sediments with a high non-sand component and higher gravel content; the lowest CPUE was on gravel substrates, the highest on sand, mixed mud, and mixed sand sediments (Mueter and Norcross 1999). The study found that the community of small, demersal fish around Kodiak Island was primarily structured along gradients of depth, water temperature, and sediment composition.

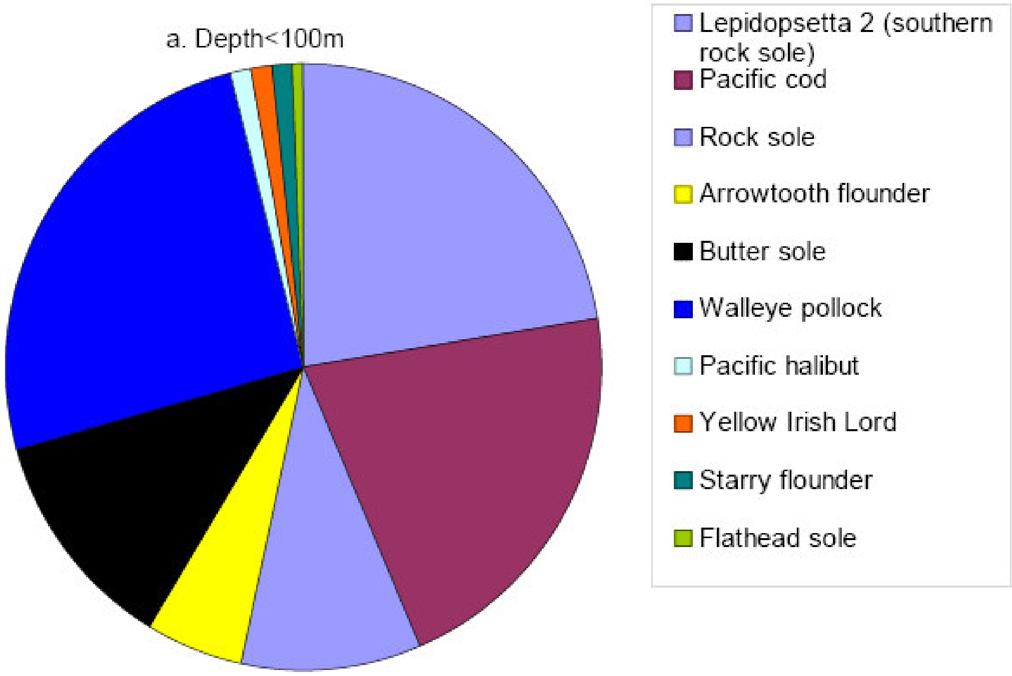
The life history of flatfishes often includes a juvenile stage during which the fish are found in concentrations at nearshore nursery areas that have narrow habitat requirements (Hurst and Abookire 2006). Nursery areas for northern rock sole (*Lepidopsetta polyxystra*) are documented in areas near, but not in, the Kodiak Airport Study Area (Stoner et al. 2007); the two closest nursery areas studied by Stoner et al. (2007) were Holiday Beach (south of the Airport Study Area) and Pillar Creek Cove (north of the Study Area). Of age 0 flatfish captured by Stoner et al. at Holiday Beach and Pillar Creek Cove, 98.3% and 95.1%, respectively, were northern rock sole; the remainder were Pacific halibut.

Pacific cod is a valuable species in the Gulf of Alaska groundfish fishery, yet little is known about the ecology of the early life stages of this species. Pelagic larvae are known to be transported by currents toward shore; they are seen around Kodiak Island between April and June and settle in nearshore waters by July (Abookire et al. 2007). Pacific halibut is also an important fishery species in the Gulf of Alaska. Pelagic larvae from offshore spawning areas settle to the bottom in shallow waters of Kodiak Island by May or June (Holladay and Norcross 1995).

Forage fishes are important pelagic species in Chiniak Bay, and seasonal peaks of capelin, eulachon, and herring have been documented in the bay (Foy 2005b). A nearshore herring fishery is active in Kodiak from April through May (Gretsch 2004). Midwater bottom trawls as part of the GAP study documented a peak of eulachon in June, followed by a peak of capelin in the bays in August (Foy 2005b). These episodes of concentrated prey are important for marine mammals, seabirds, shorebirds, and piscivorous fish in Chiniak Bay.

Although 67 species of fish were caught in bottom trawls in the Marmot and Chiniak Bay GAP surveys, the benthic habitat was dominated by arrowtooth flounder, flathead sole, walleye pollock, Pacific cod, rock sole, and eulachon (Foy 2005a). Combined, these fishes accounted for nearly 90% of the fish catch biomass (Figure 4-5). Pollock, rock sole, and Pacific cod dominated benthic habitats at depths less than 328 feet, while arrowtooth flounder, flathead sole, and Pacific cod were dominant in trawls at depths greater than 328 feet. Although seasonal biomass of groundfish appears to fluctuate near the Airport, fewer fish were observed overall in 2001, which is speculated to be due to warm oceanic conditions on the continental shelf.

Shellfish and other benthic invertebrates caught either commercially or for subsistence in open waters of Chiniak Bay include Dungeness crab, Tanner crab, red king crab, and Pacific giant octopus (Brown et al. 2001). While sidestripe shrimp (*Pandalopsis dispar*) and pink shrimp



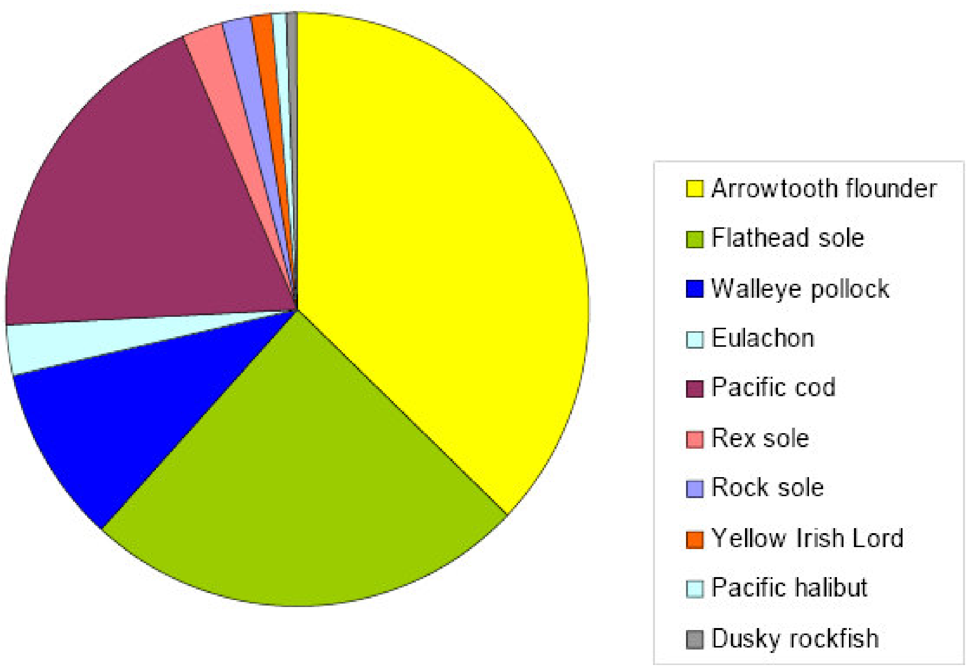


Figure 4-5. Biomass of fishes caught within 25 nautical miles of the Long Island Steller sea lion haulout during 2000–2003 bottom trawls.

Top figure indicates average composition of trawls at depths less than 328 feet; bottom figure at depths greater than 328 feet. Reprinted from Foy (2005a:13) with permission from R. Foy.

(*Pandalus borealis*) are also found in the bay, their populations were severely reduced following a late 1970s change in climate (Anderson and Piatt 1999). Weathervane scallops (*Patinopecten caurinus*) are fished in the deep waters west of Kodiak (Masuda and Stone 2003). These scallop beds occur with sea whips (*Protoptilum* spp. and *Halipteris willemoesi*) and the large anemones, crimson anemone (*Cribrinopsis fernaldi*) and plumose anemone (*Metridium senile*). No reports of weathervane scallop beds within Chiniak Bay were found. Beds of razor clams have been identified in the intertidal and shallow subtidal areas near the mouth of the Buskin River (NOAA 1997).

The sunflower sea star (*Pycnopodia helianthoides*) is a predator of marine invertebrates and a dominant sea star in the deeper waters of Chiniak Bay. Although it is fairly ubiquitous, no abundance or distribution data were found for this sea star within Chiniak Bay.

Marine habitat surveys in 2008 documented several species of marine invertebrates and algae in the intertidal and subtidal zones (see Table 4-3). Because it is not possible to accurately differentiate these observations into discrete subtidal and intertidal areas, they are discussed together in **Section 4.3.1, *Biotic Communities and Populations, Intertidal***.

Plankton are extremely abundant in Chiniak Bay. As part of the GAP study, Wang and Foy (2005) found copepods (order Copepoda) were the dominant species of zooplankton in Chiniak Bay. Other zooplankton encountered include crustacean crab zoea and euphausiids (order Euphausiacea); tunicates (*Oikopleura* spp. and *Frilillaria* spp.); and chaetognaths (*Sagitta* spp.). Euphausiids (order Euphausiacea) and amphipods (order Amphipoda) were collected during 2008 field work in intertidal and subtidal areas near the Airport (see Table 4-2).

4.4 Habitat Functions

4.4.1 Intertidal

The intertidal marine environment in the Airport Study Area functions as nursery, foraging, and spawning grounds for various fish species. Field surveys from 2007 and 2008 document use of the area by fish younger than 1 year, suggesting the area is used as a nursery ground for various species. Presence of fish greater than 1 year old indicates that the area may also be used for foraging.

Surf smelt, capelin, red Irish lord (*Hemilepidotus hemilepidotus*), and tidepool sculpin are known to spawn in the intertidal zone (Mecklenburg et al. 2002; NMFS 2005). Though it is unknown if spawning occurs in the Study Area, substrates are appropriate for spawning in some locations.

As was previously discussed, various trophic interactions occur within the intertidal and subtidal areas surrounding the Airport. Invertebrates, such as mussels, barnacles, chitons, and limpets serve as food for various larger organisms including fish and birds, some of which receive federal protection or are otherwise identified as a sensitive species. For example, the Black Oystercatcher, a sensitive shorebird species, is frequently found in Chiniak Bay and forages within the intertidal portion of the Study Area. This species primarily feeds on bivalves and other molluscs that are common in the Airport Study Area. A detailed discussion of bird species found within the Study Area is available in SWCA's technical report dealing with terrestrial vegetation and wildlife (SWCA 2009a).

4.4.2 Subtidal

Much like the intertidal marine environment, the nearshore subtidal marine environment in the Airport Study Area functions as nursery, foraging, and spawning/birthing grounds for various fish species. Field surveys from 2007 and 2008 document use of the area by fish younger than 1 year, suggesting the area is used as a nursery ground for various species. Collection of fish greater than 1 year old indicates the area may also be used for foraging.

Juvenile salmonids may use the nearshore areas near the mouth of the Buskin River during and after smolting. Smoltification is an important process in which juvenile salmonids undergo stressful physiological, morphological, and behavioral changes in preparation transition from a freshwater to marine existence.

Several species of forage fish (as defined by the federal fishery management plan [FMP] for Gulf of Alaska groundfish [NPFMC 2008]) were collected in the subtidal area during 2008 field surveys: surf smelt, Pacific sandfish, and Pacific sand lance, as well as invertebrate krill (order Euphausiacea). Additional forage fish that have been documented in Chiniak Bay (Foy 2005a) include capelin and eulachon.

Spiny dogfish shark, Pacific herring, Atka mackerel (*Pleurogrammus monopterygius*), yellowfin sole (*Limanda aspera*), and various species of skates and sculpins are known to spawn or birth in the nearshore subtidal zone (Mecklenburg et al. 2002; NMFS 2005). Though it is unknown if spawning or birthing occurs in the Study Area, habitats are appropriate in some locations.

Juvenile northern rock sole have been studied in nearby nursery areas by Stoner et al. (2007). These juveniles had consistently high densities in habitats of light to moderate worm tube density and bare sediments with dimpled surfaces. Sediments with rippled surfaces and areas with sea cucumber mounds had lower densities, while flat substrates without worm tubes had few juvenile rock sole (Stoner et al. 2007). Stoner et al. (2007) also found that juvenile rock sole had a low association with invertebrate animals' presence, small association with small clumps of algae, and no association with large clumps of algae.

Habitat associations of juvenile Pacific cod have been studied in bays southeast of the Airport Study Area in nearshore shallow water areas (Abookire et al. 2007). Young-of-the-year Pacific cod density was highest at water depths of 49 to 66 feet, was positively linearly related to the percent cover of sea cucumber (*Paracaudina chilensis*) mounds, and was not related to eelgrass (*Zostera* sp.) and macroalgae. Beach seine collections yielded Pacific cod 2.8 inches and longer in length, as well as smaller sculpins, rock sole, and Pacific sand lance (Abookire et al. 2007).

Pacific halibut juveniles sampled from inshore waters around Kodiak Island, including Chiniak Bay, were found on substrates of gravel, sand, and mud in water depths of 0 to 230 feet; these fish were most often found on sand substrates (Holladay and Norcross 1995).

Many trophic relationships exist within the nearshore subtidal marine areas surrounding the Airport. These complex interactions create a network of interconnectedness between invertebrates, fish, birds, and marine mammals. Within the Study Area, invertebrates, (such as mussels, barnacles, chitons, limpets, and cephalopods) and smaller fish (herring, trout, flounder, cod, salmonids) serve as food for larger organisms, such as larger fish, birds, and marine mammals. For example, federally protected sea otters and harbor seals are commonly found in the Study Area. Sea otters are known to prey on various invertebrates, including mussels and crustaceans, and harbor seals commonly feed on herring, trout, flounder, and cephalopods. A detailed discussion on marine mammal and bird species found within the Study Area is available in SWCA's technical report dealing with terrestrial vegetation and wildlife (SWCA 2009a).

5 ESSENTIAL FISH HABITAT

Essential Fish Habitat (EFH) is broadly defined by the Magnuson-Stevens Fishery Conservation Act (MSA) and the Sustainable Fisheries Act to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity". This language is interpreted or described in the 1997 Interim Final Rule 962 Fed. Reg. 66551, Section 600.10 Definitions. Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include historic areas if appropriate. Substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities. "Necessary" has been defined as the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. "Spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

Essential fish habitat (EFH) is identified only for species managed under a federal FMP. In the Kodiak area, most groundfish are managed under the FMP for groundfish of the Gulf of Alaska. Salmon are managed under the FMP for the salmon fisheries in the exclusive economic zone off the coast of Alaska; however, management has been deferred to the State of Alaska. Salmon EFH is analyzed in three parts: freshwater, nearshore, and marine. Freshwater EFH is specified by the Alaska Department of Natural Resources under Alaska Statute 41.14.870(a) and identified in Johnson and Weiss (2007). Marine salmonid EFH includes all estuarine and marine areas used by Pacific salmon of Alaska origin (NMFS 2005). A separate EFH assessment will be completed for this project following selection of the preferred alternatives.

Marine EFH has been identified by the National Marine Fisheries Service (NMFS) for the following salmon species found in marine and estuarine habitats in the Chiniak Bay area: Chinook, coho, chum, pink, and sockeye. Marine EFH has been identified by NMFS for at least one life history stage of the following non-salmonid marine species: walleye pollock, Pacific cod, yellowfin sole, northern rock sole, southern rock sole (*Lepidopsetta bilineata*), Alaska plaice (*Pleuronectes quadrituberculatus*), flathead sole, arrowtooth flounder, sablefish (*Anoplopoma fimbria*), rockfish, Atka mackerel, sharks, squid, skates, sculpins, and forage fish (NPFMC 2008). The Buskin River is listed as an important freshwater spawning area for chum, coho, pink, and sockeye salmon, and Buskin Lake, Lake Louise, and Lake Catherine are listed as important spawning waters for coho and sockeye salmon (Johnson and Weiss 2007). While Chinook salmon do not spawn in the Buskin River, adult Chinooks are found in Chiniak Bay. Many species with designated EFH were documented in the Airport Study Area in 2007 and 2008 (see Attachment A).

6 PROTECTED SPECIES

6.1 Species Protected under Federal Endangered Species Act

No fish, aquatic invertebrates, or aquatic plants listed under the federal Endangered Species Act (ESA) are documented in the Airport Study Area. While not listed as threatened or endangered, forage fish and invertebrates in the area are likely to be prey of the threatened southwest Alaska distinct population segment of northern sea otter (*Enhydra lutris kenyoni*), the endangered western population of Steller sea lion (*Eumetopias jubatus*), the endangered fin whale (*Balaenoptera physalus*), the endangered humpback whale (*Megaptera novaeangliae*) and the threatened Steller's Eider (*Polysticta stelleri*). A detailed discussion on these federally protected marine mammals and seabirds can be found in the 2009 SWCA marine mammal and avian technical report. Forage fish that may use the Kodiak Island area include Pacific herring, sand lance, capelin, smelt, and eulachon (see Attachment A).

6.2. Species Protected under State of Alaska Fishery Management Plans

Several other species that do not have EFH and are not listed under the ESA are still protected under State of Alaska FMPs, namely Gulf of Alaska crabs, Pacific herring, and Pacific halibut. These commercially harvested species are managed by the State of Alaska and are discussed further in SWCA 2009b.

7 Summary

This section discusses the relationships between the marine, estuarine, and freshwater habitats in the Airport Study Area. The boundary between freshwater outflow at the Buskin River and marine waters in Chiniak Bay is dynamic and influenced by the physical, chemical, and biological conditions of both systems. For example, the Alaska Stream, a major ocean current flowing west out of the Gulf of Alaska, is typically at least 50 miles east of Kodiak Island and may have little influence on the circulation in Chiniak Bay or the project area. Water circulation in the project area is typically controlled by local factors, such as tide, depth, geography, and wind (CEDS-I 2008) more than weak oceanographic ties to the Gulf. Circulation modeling for the Kodiak Airport EIS project indicates that waters in St. Paul Harbor, and particularly Womens Bay, may have relatively long residence times under typical wind conditions (CEDS-I 2008).

The size, shape, and configuration of the river mouth in relation to the Buskin River barrier bar can be a factor in the dynamics of Buskin River flood hydrology and of saltwater inflow into the river and estuarine area. Salinity variations may affect the presence and distribution of fish and invertebrates in the estuary. Alterations of river flood hydrology and hydraulics could influence the dynamics of sediment accumulation in the river and periodic flushing from the river.

The lower end of the Buskin River is a small salt wedge estuary with intertidal marsh and sand flat habitats. The estuary provides some rearing opportunities for juvenile salmonids, starry flounder, and possibly other fish species.

Nearshore marine waters in the Study Area provide habitat for a variety of fish and invertebrates. Juvenile stages of salmonids and some marine species, such as walleye pollock, have been observed in the shallow water around the Airport; however, the relative importance of this area for juvenile rearing is unknown.

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Attachment A

Habitats Used by Important Fishes and Invertebrates

Table A1. Habitats Used by Important Fishes Likely to Occur in the Kodiak Airport Study Area

Common Name (*Scientific Name*)	Habitat Use: Freshwater	Habitat Use: Saltwater-Nearshore	Habitat Use: Estuary	Importance[§]	Species Information	Documentation in Study Area
Sharks:						
salmon shark (***Lamna ditropis***)	N/A	Epipelagic	N/A	Cultural, protected species (MSA)	NOAA 2005	In Chiniak Bay, Wynne et al. 2005
spiny dogfish shark (***Squalus acanthias***)	N/A	Migrate to shallow waters in summer and for birthing (September–January)	N/A	Cultural, protected species (MSA)	NOAA 2005	In NE side of Kodiak Island, Wynne et al. 2005
Skates:						
family Rajidae (various species)	N/A	Soft substrates close to shore	N/A	Protected species (FMP)	Mecklenburg et al. 2002	In NE side of Kodiak Island, Wynne et al. 2005
Herrings:						
Pacific herring (***Clupea pallasii***)	N/A	Migratory; spawn in aquatic vegetation in shallow water	Migratory; spawn in aquatic vegetation in shallow water	Cultural, commercial, protected (State FMP)	ADF&G 1994; PSMFC 1996	In Chiniak Bay, Wynne et al. 2005
Smelts:						
surf smelt (***Hypomesus pretiosus***)	Rarely	Migratory; schools spawn in surf on ocean beaches of coarse sand to fine gravel	Sometimes found in brackish water	Cultural, protected species (FMP: forage fish)	Bargman 1998; Mecklenburg et al. 2002	Collected by SWCA 2008
capelin (***Mallotus villosus***)	N/A	Neritic; spawns on intertidal sand/gravel beaches May–July; adults use waters 50–100 m deep	N/A	Cultural, protected species (FMP: forage fish, MSA)	NOAA 2005	In Chiniak Bay, Wynne et al. 2005
rainbow smelt (***Osmerus mordax***)	Anadromous; spawn in lower reaches of streams in gravel, typically at head of tide	Nearshore	Anadromous	Cultural, protected species (FMP: forage fish)	Buckley 1989; Conners and Guttormsen 2005; Mecklenburg et al. 2002;	Habitat present
eulachon (***Thaleichthys pacificus***)	Anadromous, spawn in lower reaches of streams with sand/gravel substrate	Anadromous	Anadromous	Cultural, protected species (FMP: forage fish, MSA)	ADF&G 1994	In Chiniak Bay, Wynne et al. 2005

Table A1 (continued). Habitats Used by Important Fishes Likely to Occur in the Kodiak Airport Study Area

Common Name (*Scientific Name*)	**Habitat Use**			**Importance**§	**Species Information**	**Documentation in Study Area**
	Freshwater	**Saltwater-Nearshore**	**Estuary**			
***Salmons and trouts*:**						
pink salmon (***Oncorhynchus gorbuscha***)	Eggs fall–early spring; juveniles spring; adults July–September migration, August–September spawning in lower reaches of streams with gravel/cobbles	Juveniles summer–early winter; adults spring–fall migration, may spawn in intertidal zone with gravel/cobbles	Juveniles summer; adults spring–fall migration, may spawn in intertidal zone with gravel/cobbles	Cultural, commercial, recreational protected species (MSA)	ADF&G 1994; Groot and Margolis 2003; Johnson and Weiss 2007; S. Maclean, ADNR, pers. comm. 2007; NOAA 2005	Collected by SWCA 2008
chum salmon (***Oncorhynchus keta***)	Eggs fall–winter; juveniles spring; adults July–September migration, August–September spawning in gravels in areas with upwelling	Juveniles summer–winter; adults spring–fall migration, may spawn in intertidal zone with gravel/cobbles	Juveniles summer; adults spring–fall migration, may spawn in intertidal zone with gravel/cobbles	Cultural, commercial, protected species (MSA)	ADF&G 1994; Groot and Margolis 2003; Johnson and Weiss 2007; S. Maclean, ADNR, pers. comm. 2007; NOAA 2005	Collected by SWCA 2008; In Chiniak Bay, Wynne et al. 2005
coho salmon (***Oncorhynchus kisutch***)	Eggs fall–winter; juveniles year round; adults late August–October migration, October–December spawning in gravels	Juveniles June–September; adults July–September migration	Juveniles year round; adults late August–October migration	Cultural, commercial, recreational protected species (MSA)	ADF&G 1994; Groot and Margolis 2003; Johnson and Weiss 2007; S. Maclean, ADNR, pers. comm. 2007; NOAA 2005	Collected by SWCA 2007, 2008; In Chiniak Bay, Wynne et al. 2005
steelhead trout (***Oncorhynchus mykiss***)	Eggs spring–mid summer; juveniles year round; adults September–May migration and overwintering, April–May spawning in gravels	Adults September–November migration; juvenile outmigration in spring	Adults September–November migration; juvenile outmigration in spring	Cultural, recreational	ADF&G 1994; Johnson and Weiss 2007; S. Maclean, ADNR, pers. comm. 2007	Collected by SWCA 2007, 2008
rainbow trout (***Oncorhynchus mykiss***)	Eggs spring–mid summer; juveniles year round; adults year round, April–May spawning in gravels	N/A	N/A	Cultural, recreational	ADF&G 1994; Johnson and Weiss 2007; S. Maclean, ADNR, pers. comm. 2007	Habitat present

Table A1 (continued). Habitats Used by Important Fishes Likely to Occur in the Kodiak Airport Study Area

Common Name (*Scientific Name*)	**Habitat Use**			**Importance**[§]	**Species Information**	**Documentation in Study Area**
	Freshwater	**Saltwater-Nearshore**	**Estuary**			
sockeye salmon (***Oncorhynchus nerka***)	Eggs summer–winter; juveniles year round; adults June–July migration; summer spawning in lakes in areas with upwelling	Juveniles summer–winter; adults year round	Juveniles summer–fall; adults June–July migration	Cultural, commercial, recreational protected species (MSA)	ADF&G 1994; Groot and Margolis 2003; Johnson and Weiss 2007; S. Maclean, ADNR, pers. comm. 2007; NOAA 2005	Collected by SWCA 2008
Chinook salmon (***Oncorhynchus tshawytscha***)	N/A: Kodiak Chinook salmon limited to Karluk and Ayakulik Rivers	Adults may use study area for foraging	N/A: Kodiak Chinook salmon limited to Karluk and Ayakulik Rivers	Cultural, commercial, recreational protected species (MSA)	ADF&G 1994; Groot and Margolis 2003; Johnson and Weiss 2007; S. Maclean, ADNR, pers. comm. 2007; NOAA 2005	In Chiniak Bay, J. Dinnocenzo, ADF&G, pers. comm., Wynne et al. 2005
Dolly Varden char (***Salvelinus malma***)	Eggs September–April; juveniles year round; adults annual overwintering; July–October spawning migration, September–November spawning in gravels	Juveniles May–June; adults annual fall and spring migration	Juveniles May–June; adults annual fall and spring migration	Cultural, recreational	ADF&G 1994; Johnson and Weiss 2007; S. Maclean, ADNR, pers. comm. 2007	Collected by SWCA 2007, 2008
Cods:						
walleye pollock (***Theragra chalcogramma***)	N/A	Adults pelagic and demersal, with diurnal vertical migrations; juveniles in top 40 m of water column, widespread with no benthic habitat preference	N/A	Cultural, commercial, protected species (MSA)	NOAA 2005	Collected by SWCA 2008; In Chiniak Bay, Wynne et al. 2005
Pacific cod (***Gadus macrocephalus***)	N/A	Use mud, sand, and gravel substrates; usually at depths less than 350 m	Use mud, sand, and gravel substrates	Cultural, commercial, protected species (MSA)	NMFS and PFMC 2008	In Chiniak Bay, Wynne et al. 2005
Rockfishes:						
black rockfish (***Sebastes melanops***)	N/A	Rocky substrates	Rocky substrates	Cultural, commercial, protected species	NMFS and PFMC 2008	In Chiniak Bay, NMFS 2008b

Table A1 (continued). Habitats Used by Important Fishes Likely to Occur in the Kodiak Airport Study Area

Common Name (*Scientific Name*)	**Habitat Use**			**Importance**§	**Species Information**	**Documentation in Study Area**
	Freshwater	**Saltwater-Nearshore**	**Estuary**			
yelloweye rockfish (***Sebastes ruberrimus***)	N/A	Rocky substrates	N/A	Cultural, protected species (FMP, MSA)	NMFS and PFMC 2008	In Chiniak Bay, Meyer 2000
family Scorpaenidae (various species)	N/A	Various habitats: rocky bottoms, sand/mud/cobble substrates	N/A	Protected species (FMP)	Mecklenburg et al. 2002	In Chiniak Bay, Wynne et al. 2005
Sablefishes:						
sablefish (***Anoplopoma fimbria***)	N/A	Soft substrates, juveniles nearshore in shallow water	N/A	Protected species (FMP: forage fish)	Mecklenburg et al. 2002	In NE side of Kodiak Island, Wynne et al. 2005
Greenlings:						
kelp greenling (***Hexagrammos decagrammus***)	N/A	Rocky substrates with kelp	Rocky substrates with kelp	Cultural	NMFS and PFMC 2008	Habitat present
lingcod (***Ophiodon elongates***)	N/A	Juveniles use kelp, seaweeds, and eelgrass	Associated with kelp, seaweeds, and eelgrass	Cultural, commercial, recreational	ADF&G 1994; NMFS and PFMC 2008	In Chiniak Bay, Stock and Meyer 2005
Atka mackerel (***Pleurogrammus monopterygius***)	N/A	Intertidal to deep waters, spawn in nearshore waters	N/A	Cultural, protected species (FMP)	Mecklenburg et al. 2002	Habitat present
Sculpins:						
coastrange sculpin (***Cottus aleuticus***)	Spawning (June); adults and eggs use gravel beds of fast moving streams; larvae in backwaters	Nearshore coastal waters	Occasionally in sand/mud bottomed areas	Cultural, protected species (MSA)	Mecklenburg et al. 2002	Collected by SWCA 2007, 2008
buffalo sculpin (***Enophrys bison***)	N/A	Rocky and sandy areas; occasionally in tidepools; spawn in late winter–early spring	N/A	Cultural, protected species (MSA)	Mecklenburg et al. 2002	Collected by SWCA 2007, 2008
red Irish lord (***Hemilepidotus hemilepidotus***)	N/A	Rocky intertidal to 100 m, spawn in intertidal or shallow water	N/A	Cultural, protected species (MSA)	Mecklenburg et al. 2002; NOAA 2005;	Habitat present
Pacific staghorn sculpin (***Leptocottus armatus***)	Lower reaches	Sand/silt/shell bottomed areas; eelgrass beds; inter to subtidal	Sand/silt/shell bottomed areas; eelgrass beds; typically in lower reaches of estuaries where salinity is high	Cultural, protected species (MSA)	Mecklenburg et al. 2002	Collected by SWCA 2007, 2008
great sculpin (***Myoxocephalus polyacanthocephalus***)	N/A	Intertidal on sand and mud bottoms; also around rocks; often found near shore	N/A	Cultural, protected species (MSA)	Mecklenburg et al. 2002; NOAA 2005	Collected by SWCA 2008
tidepool sculpin (***Oligocottus maculosus***)	N/A	Resident of tidepools and sheltered intertidal areas	N/A	Cultural, protected species (MSA)	Mecklenburg et al. 2002	Collected by SWCA 2008

Table A1 (continued). Habitats Used by Important Fishes Likely to Occur in the Kodiak Airport Study Area

Common Name (*Scientific Name*)	**Habitat Use**			**Importance**§	**Species Information**	**Documentation in Study Area**
	Freshwater	**Saltwater-Nearshore**	**Estuary**			
Pricklebacks:						
family Stichaeidae (various species)	N/A	Various habitats: rocky shallow nearshore waters with seaweed, sandy intertidal to 75 m, mud/sand/pebbles in shallow water	N/A	Protected species (FMP: forage fish)	Conners and Guttormsen 2005; Mecklenburg et al. 2002	Habitat present
Gunnels:						
family Pholidae (various species)	N/A	Rocky shallow nearshore waters with seaweed	N/A	Protected species (FMP: forage fish)	Conners and Guttormsen 2005	Habitat present
Sandfishes:						
Pacific sandfish (***Trichodon trichodon***)	N/A	Adults in deeper water; larvae and juveniles in shallower, nearshore habitats; Partially bury in sand or mud; active at night	N/A	Protected species (FMP: forage fish)	Froese and Pauly 2008; Mecklenburg et al. 2002	Collected by SWCA 2008; In Chiniak Bay, Wynne et al. 2005
Sand Lances:						
Pacific sand lance (***Ammodytes hexapterus***)	N/A	Use fine gravel and sand in shallow waters near shore	Euryhaline, use fine gravel and sand in shallow waters near shore	Protected species (FMP: forage fish)	Conners and Guttormsen 2005; Robards et al. 1999	Collected by SWCA 2008
Righteye flounders:						
arrowtooth flounder (***Atheresthes stomias***)	N/A	Juveniles rear in shallow waters	N/A	Cultural, commercial, protected species (MSA, FMP)	NOAA 2005	In Chiniak Bay, Wynne et al. 2005
flathead sole (***Hippoglossoides ellasodon***)	N/A	Silty, muddy bottoms, nearshore to depths of 1,050 m, typically <366 m	N/A	Cultural, protected species (MSA, FMP)	Mecklenburg et al. 2002; NOAA 2005	In Chiniak Bay, Wynne et al. 2005
Pacific halibut (***Hippoglossus stenolepis***)	N/A	Juveniles in nearshore areas 2–50 m with soft substrates	N/A	Cultural, commercial, recreational, protected (State FMP)	NMFS 2007	In NE side of Kodiak Island, Wynne et al. 2005
butter sole (***Isopsetta isolepis***)	N/A	Inhabits muddy bottomed areas; shallow water in summer, deeper water in winter	N/A	Cultural, protected species (MSA, FMP)	Mecklenburg et al. 2002	Collected by SWCA 2008; In NE side of Kodiak Island, Wynne et al. 2005

Table A1 (continued). Habitats Used by Important Fishes Likely to Occur in the Kodiak Airport Study Area

Common Name (*Scientific Name*)	**Habitat Use**			**Importance**[§]	**Species Information**	**Documentation in Study Area**
	Freshwater	**Saltwater-Nearshore**	**Estuary**			
yellowfin sole (***Limanda aspera***)	N/A	Soft bottoms, at depths of 10–600 m, typically <150 m; spawn and rear in shallow water	N/A	Cultural, protected species (MSA, FMP)	Mecklenburg et al. 2002; NOAA 2005	In Chiniak Bay, Wynne et al. 2005
rock sole (***Lepidopsetta*** spp.)	N/A	Sandy bottomed, shallow waters; demersal	N/A	Cultural, protected species (MSA, FMP)	NOAA 2005	Collected by SWCA 2008; In NE side of Kodiak Island, Wynne et al. 2005
starry flounder (***Platichthys stellatus***)	Occasionally in soft bottomed areas	Soft bottomed areas	Soft bottomed areas	Cultural, protected species (MSA, FMP)	Mecklenburg et al. 2002	Collected by SWCA 2008; In NE side of Kodiak Island, Wynne et al. 2005
sand sole (***Psettichthys melanostictus***)	N/A	Shallow waters with sandy and muddy substrate; demersal	May be used by larvae and eggs, some adults	Cultural, protected species (MSA, FMP)	Mecklenburg et al. 2002; NOAA 2005	Collected by SWCA 2008; In Chiniak Bay, Wynne et al. 2005

[§] Table limited to species that are protected (by the MSA or Fishery Management Plans [FMP]), or are culturally, commercially, or recreationally important. Cultural significance determined by subsistence harvests by City of Kodiak residents in 1993 and by USCG Kodiak Station residents in 1991 (see SWCA 2009b).

Table A2. Habitats Used by Important Invertebrates Likely to Occur in the Kodiak Airport Study Area

Common Name (*Scientific Name*)	**Habitat Use**			**Importance[1]**	**Species Information**	**Documentation in Study Area**
	Freshwater	**Saltwater-Nearshore**	**Estuary**			
Crustaceans:						
acorn barnacle (***Balanus glandula***)	N/A	Upper intertidal, mainly on rocks	Less common	Prey for sensitive bird species	Cowles 2006	Identified by SWCA 2008
Dungeness crab (***Cancer magister***)	N/A	Resident of sand/mud substrates, mate spring–fall	Resident of sand/mud substrates	Cultural, commercial	ADF&G 1994	Collected by SWCA 2008; In Chiniak Bay, NMFS 2008a
Tanner crab (***Chionoecetes bairdi***)	N/A	Juveniles at 10–20 m with mud substrates; diel migrations, near depth of chlorophyll maximum diurnally; mating February–June nearshore	N/A	Cultural, commercial, protected species (State FMP)	NOAA 2005	In Chiniak Bay, NMFS 2008a
snow crab (***Chionoecetes opilio***)	N/A	Juveniles at <80 m; mating January–June	N/A	Cultural, protected species (State FMP)	NOAA 2005	In Chiniak Bay, Stevens 2003
red king crab (***Paralithodes camtschaticus***)	N/A	Juveniles use boulders/cobbles at depths <50 m; adults migratory, mate in shallow water <50 m January–June	N/A	Cultural, commercial, protected species (State FMP)	NOAA 2005	In Chiniak Bay, NMFS 2008a
blue king crab (***Paralithodes platypus***)	N/A	Juveniles use gravel/cobbles with shell hash at depths 40–60 m; adults use mud/sand at depths 45–75 m, mate in mid spring	N/A	Cultural, protected species (State FMP)	NOAA 2005	Habitat present
krill order Euphausiacea	N/A	In large swarms	N/A	Protected species (MSA, FMP: forage fish)	Conners and Guttormsen 2005	Collected by SWCA 2008; In Chiniak Bay, Wynne et al. 2005
Echinoderm:						
giant red sea cucumber (***Parastichopus californicus***)	N/A	Intertidal to subtidal: common in protected bays on hard and sandy substrates	N/A	Cultural, commercial	ADF&G 2008B	Habitat present

Table A2 (continued). Habitats Used by Important Invertebrates Likely to Occur in the Kodiak Airport Study Area

Common Name (*Scientific Name*)	**Habitat Use**			**Importance**[1]	**Species Information**	**Documentation in Study Area**
	Freshwater	**Saltwater-Nearshore**	**Estuary**			
Molluscs:						
Squid (***Berryteuthis magister, Rossia pacifica***)	N/A	Eggs of inshore neritic species attached to rocks; reproduce spring–early summer; juveniles at all depths and near shore	N/A	Cultural, protected species (MSA, FMP)	NOAA 2005	In Chiniak Bay, Wynne et al. 2005
Pacific giant octopus (***Enteroctopus dofleini***)	N/A	Eggs on rocks/cobble, adults may also use sand/mud	N/A	Cultural, protected species (MSA, FMP)	NOAA 2005	In Chiniak Bay, Stevens et al. 2000
Black leather chiton (***Katharina tunicata***)	N/A	Very common in middle and low intertidal zones	N/A	Prey for sensitive bird species	Cowles 2006	Identified by SWCA 2008
Pacific blue mussel (***Mytilus trossulus***)	N/A	Intertidal and subtidal	May be found in quiet bays	Prey for sensitive bird species and sea otters	Cowles 2006	Identified by SWCA 2008
dire whelk (***Searlesia dira***)	N/A	Mostly intertidal, rocky shores;	lower edges of rocks in gravel or mud in bays	Prey for sensitive bird species	Cowles 2006	Identified by SWCA 2008
mask limpet (***Tectura persona***)	N/A	Upper intertidal	N/A	Prey for sensitive bird species	Cowles 2006	Identified by SWCA 2008
plate limpet (***Tectura scutum***)	N/A	Intertidal and shallow subtidal	N/A	Prey for sensitive bird species	Colwes 2006	Identified by SWCA 2008
lined chiton (***Tonicella lineata***)	N/A	Low intertidal and subtidal, associated with rocks covered in coralline algae	N/A	Prey for sensitive bird species	Cowles 2006	Identified by SWCA 2008

[1] Table limited to species that are 1) protected (by the Magnuson-Stevens Fishery Conservation and Management Act [MSA] or Fishery Management Plans [FMP]), 2) culturally, commercially, or recreationally important; cultural significance determined by subsistence harvests by City of Kodiak residents in 1993 and by USCG Kodiak Station residents in 1991 (see SWCA 2009b) and/or 3) prey for sensitive bird species (see SWCA 2009a).

Attachment B
Timing of Life Stages for Aquatic Species in Freshwater and Marine Environments

Table B1. Timing of Life Stages for Salmonids in Freshwater Environments of the Kodiak Airport Study Area

Salmonid	Life Stage	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Dolly Varden[1]	return to freshwater												
	spawning												
	overwinter												
	adult annual outmigration												
	juvenile outmigration												
pink salmon[2]	return to freshwater												
	spawning								late				
	juvenile outmigration												
	estuary rearing (est.)												
sockeye salmon[3]	return to freshwater						late						
	spawning												
	outmigration (est.)												
	estuary rearing (est.)												
chum salmon[4]	return to freshwater												
	spawning								late				
	outmigration												
	estuary rearing (est.)												
coho salmon[5]	return to freshwater								late				
	spawning												
	outmigration												
steelhead trout[6]	return to freshwater									late			
	adult overwintering												
	spawning												
	sport fishing (catch-release)												

Key:

range of activity greater activity peak of activity

[1] Johnson and Weiss 2007; S. Maclean, personal communication, 2007; S. Schmidt, personal communication, 2008; Whalen 1991
[2] ADF&G 1994; S. Maclean, personal communication, 2007; Murray 1986
[3] Groot and Margolis 2003; S. Maclean, personal communication, 2007; Murray 1986; Schmidt et al. 2005; D. Urban, personal communication, April 2008
[4] ADF&G 1994; Groot and Margolis 2003; S. Maclean, personal communication, 2007
[5] ADF&G 1994; S. Maclean, personal communication, 2007; Murray 1986
[6] Groot and Margolis 2003; S. Maclean, personal communication, 2007; Murray 1986

Table B2. Timing of Life Stages for Aquatic Species in Marine Environments of the Kodiak Airport Study Area

Species	Life Stage	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Dolly Varden[1]	congregate offshore												
	return to freshwater												
	adult annual outmigration												
	juvenile outmigration												
pink salmon[2]	return to freshwater												
	juvenile outmigration												
	estuary rearing (est.)												
sockeye salmon[3]	return to freshwater						late						
	outmigration (est.)												
	estuary rearing (est.)												
chum salmon[4]	return to freshwater												
	outmigration												
	estuary rearing (est.)												
coho salmon[5]	adults congregate offshore								peak: week 3				
	return to freshwater								late				
	outmigration												
Chinook salmon	adults in salt water												
steelhead trout[6]	return to freshwater									late			
	sport fishing (catch-release)												
red king crab[7]	reproductive activity, including hatch												
	pelagic larval stage												
	larval settlement												
	nearshore migration: age 4+												
Dungeness crab[8]	molting/mating												
	egg extrusion												
	larval hatching												
Pacific sandlance[9]	nearshore activity, adults												
	adult spawning												
	eggs present, in gravel/sand												
	larval presence/hatching												
capelin[10]	adult spawning												
	eggs present, in gravel/sand												
	larval presence/hatching												

Key:

range of activity

greater activity

peak of activity

[1] S. Maclean, personal communication, 2007; S. Schmidt, personal communication, 2008; Whalen 1991
[2] ADF&G 1994; Murray 1986
[3] S. Maclean, personal communication, 2007; Murray 1986; Schmidt et al. 2005; D. Urban, personal communication, April 2008
[4] Groot and Margolis 2003; S. Maclean, personal communication, 2007
[5] ADF&G 1994; Johnson and Weiss 2007; Murray 1986
[6] Groot and Margolis 2003; Murray 1986
[7] P. Cumminskey, personal communication, 2008; Jewett and Onuf 1988; E. Munk, personal communication, 2008
[8] K. Swiney, personal communication, 2008
[9] S. Payne, personal communication, 2008; Robards et al. 1999
[10] S. Maclean, personal communication, 2007; NPFMC 2009; Ormseth et al. 2008

Terrestrial Vegetation and Wildlife, and Marine Mammals and Seabirds Technical Report for Kodiak Airport Environmental Impact Statement, Kodiak, Alaska

Prepared for

Federal Aviation Administration
Alaska Department of Transportation and Public Facilities

Prepared by

SWCA Environmental Consultants

September 2009

TERRESTRIAL VEGETATION AND WILDLIFE, AND MARINE MAMMALS AND SEABIRDS TECHNICAL REPORT FOR KODIAK AIRPORT ENVIRONMENTAL IMPACT STATEMENT, KODIAK, ALASKA

Prepared for

Federal Aviation Administration
Alaska Department of Transportation and Public Facilities

Prepared by

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September 16, 2009

CONTENTS

APPENDICES

FIGURES

TABLES

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1 INTRODUCTION

This technical report has been prepared in conjunction with an environmental impact statement (EIS) for the Kodiak Airport (Airport). The purpose of the proposed federal actions at the Airport is to bring the Airport runways into compliance with the Federal Aviation Administration (FAA) runway safety area (RSA) standards to the greatest extent practicable. The FAA requires that commercial airports have RSAs, which serve as buffers should aircraft deviate from the runway during an accident or emergency. The required size standards of these RSAs are based on the types of aircraft served at each runway.

The runway system at the Airport consists of three runways: 07/25, 11/29, and 18/36. Runway 11/29 meets current FAA design standards, but runways 07/25 and 18/36 do not include the length of RSA necessary at the runway ends to provide adequate overrun or undershoot protection. FAA is preparing an EIS to evaluate the environmental consequences of enhancing RSAs on runways 07/25 and 18/36 at Kodiak Airport.

This report provides a detailed description of the terrestrial (upland) vegetation and wildlife resources, marine mammals, and seabirds potentially affected by the proposed RSA projects at the Airport. It includes information on the federally listed threatened and endangered species and other species of conservation concern known to occur or with potential to occur in the vicinity of the Airport. Data collected during the various field studies described below is available for agency review. Upon request, the EIS Team will provide this data in electronic spreadsheet format. Separate technical reports provide information on other components of the Airport's biotic community, such as wetlands and freshwater and marine fishery resources.

2 VEGETATION RESOURCES

This section of the technical report describes the various land cover types and plant community types that occur on and around the Airport Study Area (Study Area), which consists of the existing Airport property and surrounding areas with potential to be affected by one or more of the proposed actions and alternatives (Figure 1). The land cover types in the Study Area were identified and mapped to describe the affected environment for the Airport EIS and to provide a description of baseline conditions for assessment of potential impacts caused by proposed Airport developments.

Large portions of the Study Area have been developed and/or disturbed, as is apparent in the aerial photography used to map vegetation (see Figure 1). Some Airport areas that were disturbed have since revegetated. These areas are mapped according to their current (as opposed to "natural" or pre-disturbance) land cover type.

2.1 Methods

Vegetation mapping was accomplished through a combination of fieldwork and geographic information system (GIS) mapping. Between September 18 and 20, 2007 biologists used GPS units and aerial photographs to create "ground-truth points" within different recognizable plant communities in the vicinity of the Airport. Plant community names and species compositions are based on existing cover types described for the Kodiak Archipelago (Flemming and Spencer 2007), hereafter referred to as the Archipelago. Ground-truth points were used to link land cover and plant community type data taken in the field with the different colors and textures of vegetation apparent in the photos. Boundaries were then digitized around polygons of similar color and texture, and communities were assigned according to the

GPS data and field notes. Ground-truthing of the vegetation mapping was completed during a July 2008 site visit. This effort included updating the vegetation map to reflect forest clearing that has occurred at the Airport since the aerial photographs were taken.

2.2 Airport Study Area

The Study Area consists of the Airport property and immediately adjacent lands and waters (including the forested area south of Runway 07/25, the Buskin River, portions of Buskin River State Park, and nearshore marine waters adjacent to these lands) with potential to be directly or indirectly impacted by RSA expansion on one or more runways. There are 12 land cover types mapped in the Study Area; these are shown on Figure 1. Information on the number of acres of each of these land cover types within the Study Area is provided in Table 1. Common names of plants are used throughout this section. Please refer to Appendix A for a more complete list of plants at the Airport, including their scientific names and associated land cover types.

Table 1. Land Cover Types in the Study Area

Land Cover Types	Acreage	Percent of Study Area
Rocky Shore	3.9	0.4
Sand and Gravel Beach	4.7	0.4
Elymus Grassland	8.6	0.8
Elymus Forb Meadow	210.0	19.4
Alder-Salmonberry-Elderberry	50.7	4.7
Sitka Spruce Forest	147.7	13.7
Alder Willow Mix	92.0	8.5
Rivers and Streams	22.5	2.1
Marine Waters	317.3	29.4
Disturbed	218.7	20.2
Fresh Water Wetland	0.9	0.1
Sedge Marsh	3.6	0.3
Total	**1,080.6**	**100.0**

Source: SWCA 2008

Descriptions of the above land cover types, including their primary and secondary dominant species (if vegetated) and their general location within the analysis area, are provided below. Figure 1 shows the distribution and abundance of these land cover types within the Study Area.

2.2.1 Rocky Shore

The Rocky Shore cover type consists of mostly bare and moss-covered rocks. It includes areas of natural rock outcrops and areas where armor rock has been placed to protect runway ends from erosion. This cover type occurs in association with the Sand and Gravel Beaches cover type along the eastern and northeastern edges of the Airport where the Airport borders Chiniak Bay and the mouth of the Buskin River.

Figure 1. Land cover types within the Study Area boundary.

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2.2.2 Sand and Gravel Beach

The Sand and Gravel Beach cover type consists of mostly bare sand and gravel substrates with occasional (less than 5% cover) herbaceous species, including seabeach sandwort, sea bluebells, and beach groundsel. This cover type occurs in association with the Rocky Shore cover type found along the eastern and northeastern edges of the Airport where the Airport borders Chiniak Bay and the mouth of the Buskin River.

2.2.3 Elymus Grassland

The Elymus Grassland cover type is a plant community dominated by the salt-tolerant species American dunegrass. Another grass, bluejoint, is a secondary dominant in wetter areas and an occasional forb, primarily beach pea, is also found in this cover type. Elymus Grassland occupies narrow strips along the tops of the Sand and Gravel Beaches cover type and is adjacent to the Buskin River estuary in the eastern and northeastern portions of the Study Area.

2.2.4 Elymus Forb Meadow

The Elymus Forb Meadow cover type consists of the Elymus Forb Meadow plant community. It is the most botanically diverse of the plant communities within the Study Area. The most common plant species consist of American dunegrass, bentgrass, clover, sheep sorrel, common plantain, common yarrow, and beach pea. At the Airport this cover type also includes small patches of mowed Sitka spruce and Sitka willow saplings. This cover type occurs between and adjacent to the runways at the Airport.

2.2.5 Alder-Salmonberry-Elderberry

The Alder-Salmonberry-Elderberry cover type consists of a plant community with a dense overstory of shrub species dominated by Sitka alder, salmonberry, and elderberry. Low-growing, herbaceous species in this cover type include bentgrass, sheep sorrel, and fireweed. This cover type occurs along the edges and in openings surrounded by a Sitka Spruce Forest and Alder Willow Mix matrix.

2.2.6 Sitka Spruce Forest

The Sitka Spruce Forest cover type consists of a plant community with a dense overstory of Sitka spruce (greater than 60% cover). In the less dense areas, Sitka alder and salmonberry are common understory shrub species. Common, low-growing, herbaceous species include bluejoint reedgrass, fireweed, bentgrass, cow parsnip, lady fern, and sheep sorrel. In the denser areas, mosses are the dominant groundcover. Sitka Spruce Forest occurs as a mosaic with the Alder Willow Mix community surrounding portions of the runways at the Airport.

2.2.7 Alder Willow Mix

The Alder Willow Mix cover type is a plant community with an overstory dominated by Sitka willow and Sitka alder with the occasional black cottonwood. Understory species include fireweed, bentgrass, clover, and seacoast angelica. This community occurs as a mosaic with Sitka Spruce Forest surrounding large portions of Airport.

2.2.8 Rivers and Streams

The Rivers and Streams cover type includes the perennial waterways within the Study Area, including Devil's and Louise Creeks, the Buskin River, and the Buskin River Estuary. The vegetation within and immediately adjacent to Drury Gulch and small, unnamed streams in the Study Area are discussed in Section E.2 of the Wetland Delineation Report (Vigil-Agrimis 2008). Riparian vegetation adjacent to Rivers and Streams include dense stands of cottonwood, willow, and alder. Refer to the Freshwater and Marine Ecology Technical Report (SWCA 2009) for a detailed description of this aquatic cover type.

2.2.9 Marine Waters

The Marine Waters cover type includes intertidal and subtidal marine waters of Chiniak Bay, which are located along the eastern and northeastern edges of the Airport property. Refer to the Freshwater and Marine Ecology Technical Report (SWCA 2009) for a detailed description of this marine cover type.

2.2.10 Disturbed Lands

The Disturbed Lands cover type includes buildings, runways, graded areas, and gravel roads throughout the Study Area.

2.2.11 Freshwater Wetland

The Freshwater Wetland cover type includes both shrub-dominated and forb-dominated freshwater wetlands. Where this cover type occurs along the lower Buskin River, it is characterized by willow and bluejoint, with mud sedge in wetter areas. Freshwater Wetland is also present in narrow stringers adjacent to the airfield, where it is dominated by various combinations of tussock cottongrass, sparseflower sedge, meadow barley, common spikerush, ovate spikerush, Kellog's sedge, and/or a species of rush, *Juncus alpinum*. Refer to the Wetland Delineation Report (Vigil-Agrimis 2008) for more information on wetlands within the Study Area.

2.2.12 Sedge Marsh

The Sedge Marsh cover type is present in the estuarine zone adjacent to the mouth of the Buskin River in the northeast section of the Study Area. This cover type is frequently inundated during high tides and/or peak river flows and is dominated by Lyngbye's sedge and mud sedge. This cover type corresponds to the lower portions of “Wetland A” described in the Wetland Delineation Report (Vigil-Agrimis 2008).

2.3 Landscape Area

The Landscape Area for terrestrial vegetation and wildlife was determined by estimating the boundaries of a surrounding area that could influence or be influenced by the species composition of the various plant communities located in the Study Area. For example, noxious weeds introduced in the Study Area could spread to the Landscape Area and vice versa. The Landscape Area for terrestrial vegetation and wildlife includes approximately 19,180 acres and comprises the Buskin River, Devil's Creek, Louise Creek, Drury Gulch, and tributary watersheds within which the Airport is located (Figure 2). Fifty-four different plant communities occur in the Landscape Area. The dominant plant community types in the Landscape Area are Alder-Salmonberry-Elderberry (990 acres), Open Cottonwood (990 acres), Disturbed Area (1,190 acres), Alpine Forb Meadow (1,270 acres), Dense Alder (2,670 acres), and Alder-Forb Meadow (4,250 acres). Dominant community types not described in the previous section are described below. Plant community descriptions and acreages are based on vegetation mapping conducted for the Archipelago (Flemming and Spencer 2007).

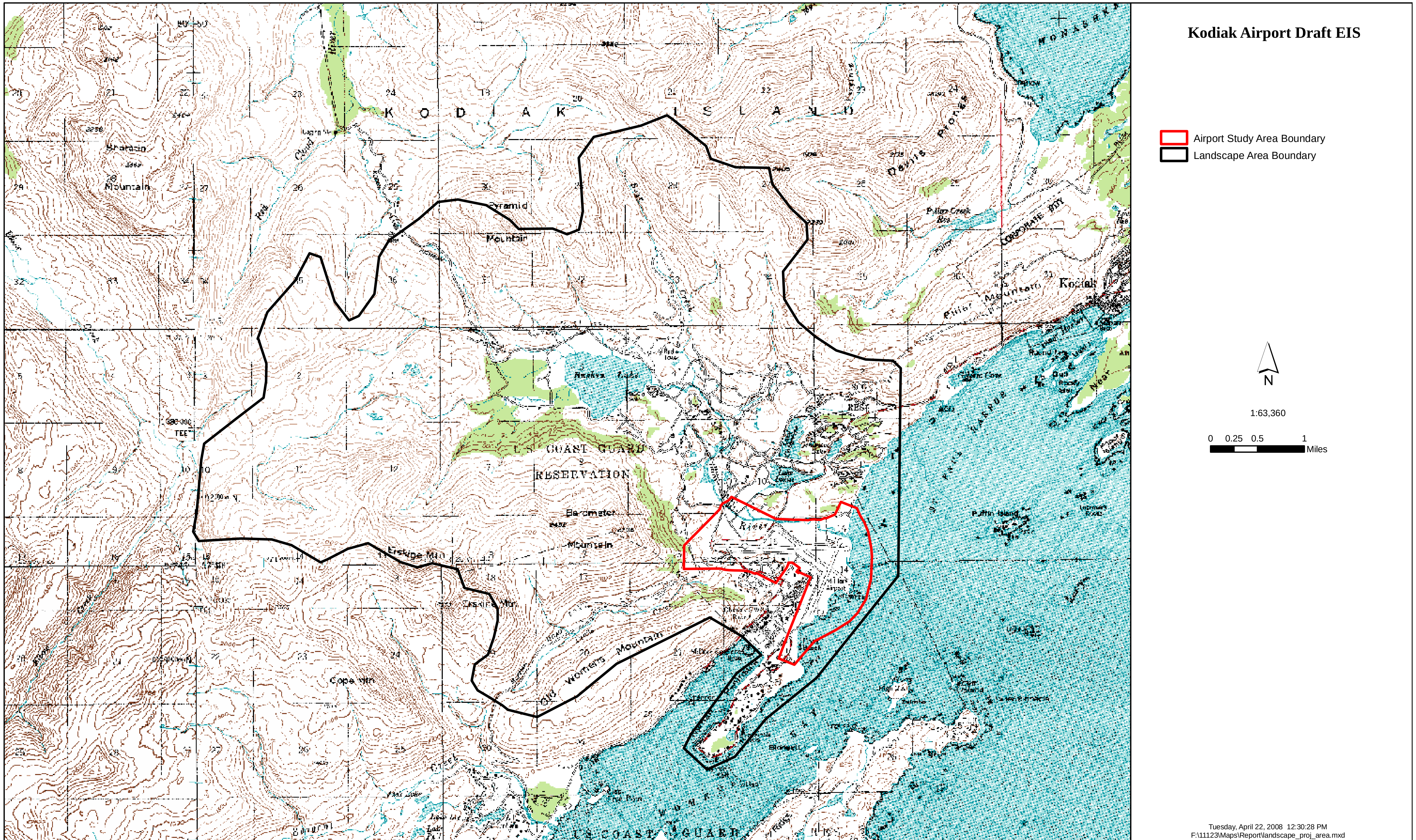

Figure 2. Terrestrial vegetation and wildlife Study Area boundary and Landscape Area boundary.

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2.3.1 Open Cottonwood

The Open Cottonwood plant community has 10% to 60% vegetative cover; black cottonwood is the dominant overstory species in this plant community and the understory includes Sitka willow, Sitka alder, ferns, forbs, and grasses. This community is found on gentle slopes and in riparian areas.

2.3.2 Alpine Forb Meadow

The Alpine Forb Meadow plant community is a diverse mix of forbs, grasses, and ferns growing on steep slopes or in alpine basins above the alder zone. Common species in this community include lupine, paintbrush, sedges, fireweed, and goldenrod.

2.3.3 Dense Alder

The Dense Alder plant community comprises 60% to 100% Sitka alder. It is found from sea level to 3,000 feet. Maidenhair fern, grasses, and the occasional salmonberry make up the understory of this plant community.

2.3.4 Alder-Forb Meadow

In the Alder-Forb Meadow plant community, Sitka alder grows in patches covering 20% to 50% of an area. Common understory species include ferns and grasses. Lupine, goldenrod, fireweed, and other forbs form patches of meadow.

2.4 Threatened, Endangered, and Sensitive Plants

There are no federally listed threatened or endangered plants or state-listed plants with habitat or potentially suitable habitat in the Study Area or Landscape Area. According to the Alaska Rare Plant Field Guide, there are three sensitive plant species with potential to occur in the Study Area: sessile-leaved scurvy-grass (*Cochlearia sessilifolia*), Calder's lovage (*Ligusticum calderi*), and upswept moonwort (*Botrychium ascendens*) (Lipkin and Murray 1997). The sessile-leaved scurvy-grass is endemic to gravel bars in the intertidal zone on Kodiak and Sitkalidak islands. Suitable habitat for sessile-leaved scurvy-grass was surveyed in and adjacent to the Study Area during low to medium tides during the September 2007 field surveys. No individuals of this species were located during the survey. The Calder's lovage is known to occur on Kodiak Island at 1,900 to 2,100 feet in elevation. There is no suitable habitat for this species in the Study Area. There are two records of upswept moonwort populations in Alaska; neither of which are located on Kodiak Island (Lipkin and Murray 1997). Potentially suitable sandy sites and mesic meadows in the Study Area were surveyed for upswept moonwort in September 2007 and no individuals were found.

2.5 Noxious Weeds

There are 27 species of noxious weeds and invasive plant species with potential to occur at the Airport. During the 2007 field surveys SWCA biologists located one population of Canada thistle (*Cirsium arvense*) at the Airport. The population consisted of approximately 50 individuals within a 1-acre area. In July 2008 SWCA biologists located a small population of orange hawkweed (*Hieracium aurantiacum*) in the Study Area. This population consisted of approximately three individuals within a circular area with a 2-m radius (Figure 1). The three plants were pulled out and destroyed.

3 WILDLIFE RESOURCES

This section of the technical report provides information concerning upland wildlife, marine mammals, and seabirds within the Study Area and Landscape Area. Two different field survey efforts, conducted over the course of one year, comprise the primary sources of information on wildlife in the two analysis areas.

3.1 Methods

The methods by which SWCA collected or compiled information on wildlife in the Study and Landscape areas are described below. It should be noted that the Landscape Area for upland wildlife is the same as that identified in Section 2.3, i.e., the Buskin River, Devil's Creek, Louise Creek, Drury Gulch and tributary watersheds within which the Airport is located (Figure 2). The Landscape Area for marine mammals and seabirds consists of Chiniak Bay and its sub-bays St. Paul Harbor, Women's Bay, Middle Bay, and Kalsin Bay. Chiniak Bay was chosen as the marine Landscape Area in order to provide a larger context for survey findings within the Airport Study Area. Marine habitats adjacent to the Airport are represented in several locations around Chiniak Bay and the bay is itself a distinct geographic unit as distinguished from the outlying Gulf of Alaska and the various straits and bays to the north and south. Information on wildlife within the Study and Landscape areas was derived from existing information, Airport field surveys (upland and shore-based marine wildlife surveys), and boat-based surveys.

3.1.1 Existing Information

Existing information was used in developing a preliminary understanding of wildlife known to occur or with potential to occur in the Study and Landscape areas. Information sources were obtained through Internet searches, conversations with scientists at state and federal agencies, and coordination with the Alaska Audubon Society. Where relevant, existing information sources are cited, as appropriate, in the results section below. Additional sources of existing information include the personal observations of local project staff.

One of the main sources of information used to develop an initial understanding of wildlife within the Study Area was the Airport's Wildlife Hazard Assessment (WHA) (USDA 2000). This assessment provided detailed information on bird and mammal species observed at the Airport over the course of one year. Other important preliminary information sources included U.S. Fish and Wildlife Service (USFWS) papers documenting the results of aerial surveys for Steller's Eider in the Archipelago (Larned and Zwiefelhofer 2001, 2002).

Another important source of information was a list of birds known to occur in the Study Area. This list was compiled from bird observations from three sources. Almost all observations were extracted from the unpublished files of Richard MacIntosh, a biologist and long-time resident of Kodiak Island. These observations were made over a 36-year period from 1973 to 2008. There were no standardized protocols used in recording these observations. Data typically recorded included general location of observation, species encountered, estimated number of each species encountered, supplemental notes on unusual species, unusual numbers, etc. Roughly 95% of the observations used to compile the checklist were made by MacIntosh. Other contributors were Jeff Allen, William Donaldson, Molly MacIntosh, Larry Mayo, David Menke, Joseph Metzler, John Pfeiffer, Jeanne Pontti, and Denny Zwiefelhofer. Another source of data used in compiling the bird list was the WHA (USDA 2000).

Bird observations from the MacIntosh files were made mostly in areas outside the current Airport Controlled Area, i.e., the fenced portion of the Study Area including the apron, runways, and taxiways. These areas included the marine waters off the mouth of the Buskin River, the Buskin River corridor inland to the Chiniak Highway bridge, the wooded area along the south side of Runway 07/25, marine waters off Finney Beach, Finney Beach, and the crash boat harbor area east of Runway 18/36 (which was not in the Controlled Area in the 1970s).

3.1.2 Upland Wildlife and Shore-based Marine Wildlife Surveys

3.1.2.1 Point-count Surveys

Prior to initiation of the Kodiak Airport EIS, the primary source of information on wildlife within the Study Area was the Airport's WHA (USDA 2000). The standardized surveys conducted as part of the WHA established 11 point-count stations around the airfield. All wildlife activity within 600 feet of these points was recorded several times per month over the course of one year from May 1999 to April 2000.

The WHA provided good information on the relative abundance of various bird and mammal species that occur on the Airport property throughout the year. However, because the surveys conducted for the WHA were more than eight years old, it was determined that current data would be necessary to accurately characterize existing conditions for wildlife within the Study Area.

To update and supplement the WHA, the EIS team initiated wildlife surveys at the Airport in September of 2007. During this initial site visit, point-count stations were established based on the location of points used in the WHA, with slight modifications to better address EIS objectives. Points located adjacent to runway ends were moved to the center of runway ends to improve the accuracy of observations in the areas that would be affected by RSA construction. Runway-end points were also given a larger survey radius and extended sampling duration to better cover the area of potential direct and indirect effects, and to increase the potential for observing marine mammal use of these areas. In addition, two points were added to evaluate wildlife habitat use on the south side of the Airport, outside of the existing property boundary in an area initially considered for use as a fill source for RSA construction. Figure 3 shows the location of these point-count stations around the Airport.

Systematic surveys of these points were initiated in November 2007 and continued through October, 2008. This work included surveys conducted one to three times per month. A copy of the survey protocol as well as a sample data sheet may be found in Appendix B. For survey and analysis purposes, the point-count stations were divided into upland points and coastal points, as described below.

3.1.2.1.1 Upland Points

Nine upland points, including B1–B4, B6, and B10–B13, were surveyed for upland birds and other wildlife. Points B12 and B13 were established on the south side of the Airport to characterize the wildlife community in this area—should the area be proposed for development as a quarry site to provide fill for RSA expansion. The survey protocol for upland points was generally based on the USFWS breeding bird survey protocol (Robbins et al. 1986 as cited in USDA 2000), one of the survey methods used in the WHA. At these points, wildlife activity within a 600-foot radius was recorded for 10 minutes. These 10 minute counts were broken down into 0 to 3, 3 to 5, and 5 to 10 minute intervals. During the breeding season, morning surveys were conducted during peak bird activity. During non-breeding times of the year, surveys were done anytime during daylight.

3.1.2.1.2 Coastal Points

Four coastal points (Points B5, B7, B8, and B9) were surveyed and can be seen on Figure 3. These points, although loosely replicating those used in the WHA, were shifted to the RSA centers at the runway ends. As mentioned above, the survey radius and sampling time for these points were increased to enhance data collection for seabirds and marine mammals using nearshore marine habitat within the potential RSA disturbance footprints. At the coastal points all wildlife activity within approximately 2,500 feet (762 m), or as far as weather conditions would allow, was recorded for 30 minutes. These 30-minute counts were broken down into 0 to 3, 3 to 5, 5 to 10, and 10 to 30 minute intervals. Distances to each observation were estimated based on reference markers/buoys placed 1,000 ft from the runway ends. These surveys were conducted according to the schedule in Table 2. In order to compare and contrast observations from each of the runway ends and minimize the potential for double-counting marine wildlife observed from adjacent survey points, point survey boundaries were established (Figure 3). These boundaries were established in the field by identifying coordinates for and placing a buoy on the point at which two survey radii intersect. A corresponding point on the Airport shoreline was identified and marked in the field and a more distant landmark in line with these two points (e.g., the northern tip of Zaimka Island for the survey boundary between points B5 and B7) was identified. Only those marine wildlife observed on the near side of the point survey boundary were recorded for a given point.

3.1.2.1.3 Point-count Survey Schedule

Table 2 shows the number of surveys per month for the upland and coastal points. Surveys could be completed at any time during a given month with a minimum five-day buffer between surveys when possible. Differences in monthly sampling frequencies between upland points and coastal points reflects different seasonal survey objectives for upland birds and seabirds.

Table 2. Monthly Survey Schedule for Airport Point Counts

Month	Upland Points	Coastal Points
January	1	3
February	1	3
March	1	2
April	3	1
May	3	1
June	3	1
July	3	1
August	1	1
September	1	1
October	1	1
November	1	2
December	1	3

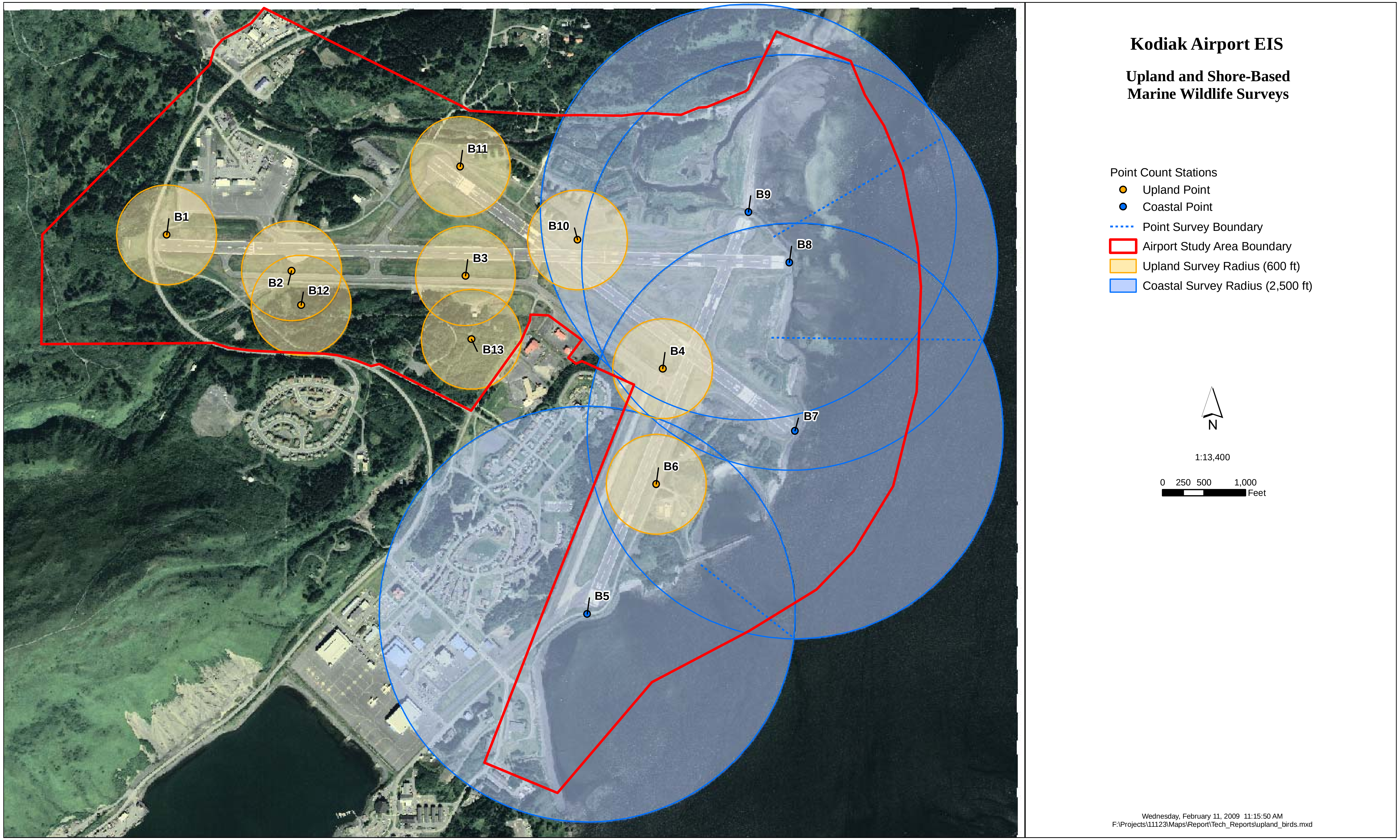

Figure 3. Airport Study Area with point-count stations.

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3.1.2.2 Small Mammal Surveys

In addition to the above point counts, a limited, small mammal trapping effort was conducted in September of 2007. This effort was conducted in the undeveloped area south of Runway 07/25 (in the vicinity of point-count stations B12 and B13) to determine if there were substantial populations of small mammals such as mice, voles, and/or shrews in the area that could provide a prey source for raptors and foxes and could be affected by development of a fill borrow source for RSA construction.

Four survey lines of ten traps each were set up in two different land cover or habitat types. The traps were placed 10 m apart from each other, and traps were checked for three consecutive days, once in the morning and once in the evening. The type of trap used for this small mammal survey was the folding aluminum Sherman Live Capture Trap (3”×3.5”× 9”). The four survey lines were chosen based on habitat type and the possibility that existing habitat in the area would be lost as a result of quarry development. The habitat types sampled included Sitka Spruce Forest and Alder Willow Mix. Surveys were conducted between September 17 and 21, 2007. Late summer and early fall are typically the optimal times to trap rodents, because the animals are less likely to have young. This minimizes the potential for a survey to have adverse effects on small mammal reproduction and population dynamics.

The trap lines were established one day in advance of baiting. This allowed time for animals to acclimate to the presence of traps prior to the traps being set. A plastic tape measure was used to measure 10 m between each trap location. Each trap location was marked temporarily with flagging tape or with wire stakes with vinyl flagging. Some liberty was taken on a smaller scale to decide where to place each trap to increase the chance of successful capture at that site. For example, if a rodent burrow is found a couple of feet away from a trap point, the trap can be placed closer to the burrow in the hopes of capturing that individual. Traps were initially left with the door closed to avoid accidental trappings before baiting.

Bait for the traps was prepared from peanut butter and rolled oats rolled into approximately 0.5-inch diameter balls and wrapped in a perforated piece of waxed paper to reduce fouling of the trap. Traps were baited in the evening and bait was replaced as needed. When baiting the traps, the sensitivity of the treddle was tested at the back of the trap by pressing lightly on the back door to trip the spring. The sensitivity of the trap was adjusted as needed by bending the treddle slightly against or away from the spring at the back of the trap. Once the proper sensitivity was achieved, a ball of bait was placed inside the trap along with several cotton balls into the back of the trap. The cotton balls are meant to provide overnight insulation for a captured mammal, and do not necessarily need to be on the treddle, where the bait should be placed, when the trap is set. The trap was then placed gently on the ground with the front door open. The opening was placed toward any nearby burrows to encourage capture.

Traps were checked by surveyors as soon after sunlight as possible and then again in the evening. Three nights of trapping or 120 trap-nights were completed for this survey effort.

3.1.3 Boat-based Surveys

The northern sea otter was listed by the USFWS as a threatened species in August 2005. Due to the lack of information on this species in the Kodiak area and its protected status under the Endangered Species Act (ESA) and Marine Mammal Protection Act, the EIS team in consultation with USFWS determined that boat-based otter surveys of Chiniak Bay (the Landscape Area for marine species) were needed. These surveys had the additional benefit of providing current, quantitative information on other marine mammals and seabirds of conservation concern present in the Landscape Area. Because the northern sea otter is federally listed under the ESA, surveys for this species require a permit from the USFWS. A Federal Fish and Wildlife Permit was applied for and received by the EIS Team. As part of the permit approval process, a marine mammal incidental harassment authorization was applied for and received from the National Marine Fisheries Service. While the EIS Team permit was being processed, surveys were carried out under the auspices and supervision of USFWS personnel. Doug Burn of the USFWS provided administrative support and input on survey design and data analysis. Angie Doroff, formerly of USFWS, participated in the three survey efforts, the first two of which were carried out under an existing permit held by the USFWS. The final survey effort was completed under the authority of Permit MA167514-0 issued to Catherine Foy and Spencer Martin of the EIS Team.

Surveys for the northern sea otter, other marine mammals, and seabirds were conducted in Chiniak Bay generally following the survey protocol described in Boat-based Population Surveys of Sea Otters in Prince William Sound (Burn 1994). Given that sea otters are known to use Chiniak Bay throughout the year, boat-based surveys were planned to be conducted in each of the four seasons when weather and sea conditions were favorable. Surveys were completed in February, May, and early September 2008. Weather conditions in the late-fall or early-winter of 2008 did not allow for a survey to be conducted during that season.

Surveys were conducted using a stratified sampling design to characterize sea otter (and other marine wildlife species) distribution and abundance in the Study Area (nearshore and pelagic waters adjacent to the Airport) and Landscape Area (Chiniak Bay). Sampling strata included nearshore and pelagic survey units. These were further divided into Study Area and Landscape Area survey units for a total of four sampling units (Figure 4). Note that the Study Area for the boat-based surveys differs from the Study Area used in the Airport point-count surveys. For the boat-based surveys, the Study Area was expanded to include nearshore and pelagic habitats in St. Paul Harbor and the lower portion of Women's Bay within approximately 2.5 miles of the Airport. The larger Study Area used in the boat-based surveys allowed the EIS Team to take advantage of this more extensive survey methodology to characterize marine wildlife use of waters in the vicinity of the Airport in the context of Chiniak Bay as a whole.

The nearshore survey stratum was sampled using a trackline approach. To facilitate data acquisition and analysis, this trackline was broken up into a series of transects of varying sizes separated by landmarks (such as headlands or streams) easily identified from the water. The length of shoreline that was sampled during each survey event comprised at least 50% of the total shoreline transects, and the individual, numbered transects sampled during each event were selected by random. Shoreline transects in the Study Area were sampled during each survey event. In sampling shoreline transects, the survey vessel set a course parallel to and 100 m from the shoreline and circumnavigated Chiniak Bay, including its sub-bays. At least two observers (in addition to the captain of the vessel) recorded the number and location of sea otters and other marine wildlife, each surveying up to 100-m out, perpendicular to the sides of the vessel, making up a 200-m-wide survey transect. The 100-m survey boundary was estimated by the observers with periodic "calibration" using a laser range finder and/or float tied to a 100-m line. The number and location of all sea otters and other marine mammals were recorded using GPS. Incidental observations of seabirds were recorded by transect. Behavior and other pertinent observations were recorded on paper data sheets. Surveys were conducted at a survey speed of 5 to 10 knots. Onboard GPS was used to track the route surveyed.

Waters in the pelagic survey stratum were also sampled using a randomized transect design. A series of north-south transects 200 m wide, approximately 2 statute miles long, and covering all of Chiniak Bay was established (Figure 4). Where survey transects intercepted land, the transect length was shortened accordingly. All pelagic transects were surveyed at a boat speed of 10 to 15 knots. Pelagic transects in the Study Area were planned to be surveyed at a sampling intensity of 20% (or 12 transects per survey), whereas pelagic transects in the Landscape Area were planned to be surveyed at a sampling intensity of 5% (25 transects per survey). The numbers of transects (particularly those located in the more open, exposed portions of Chiniak Bay) that were actually sampled per survey varied depending on weather conditions and sea state at the time of the survey event.

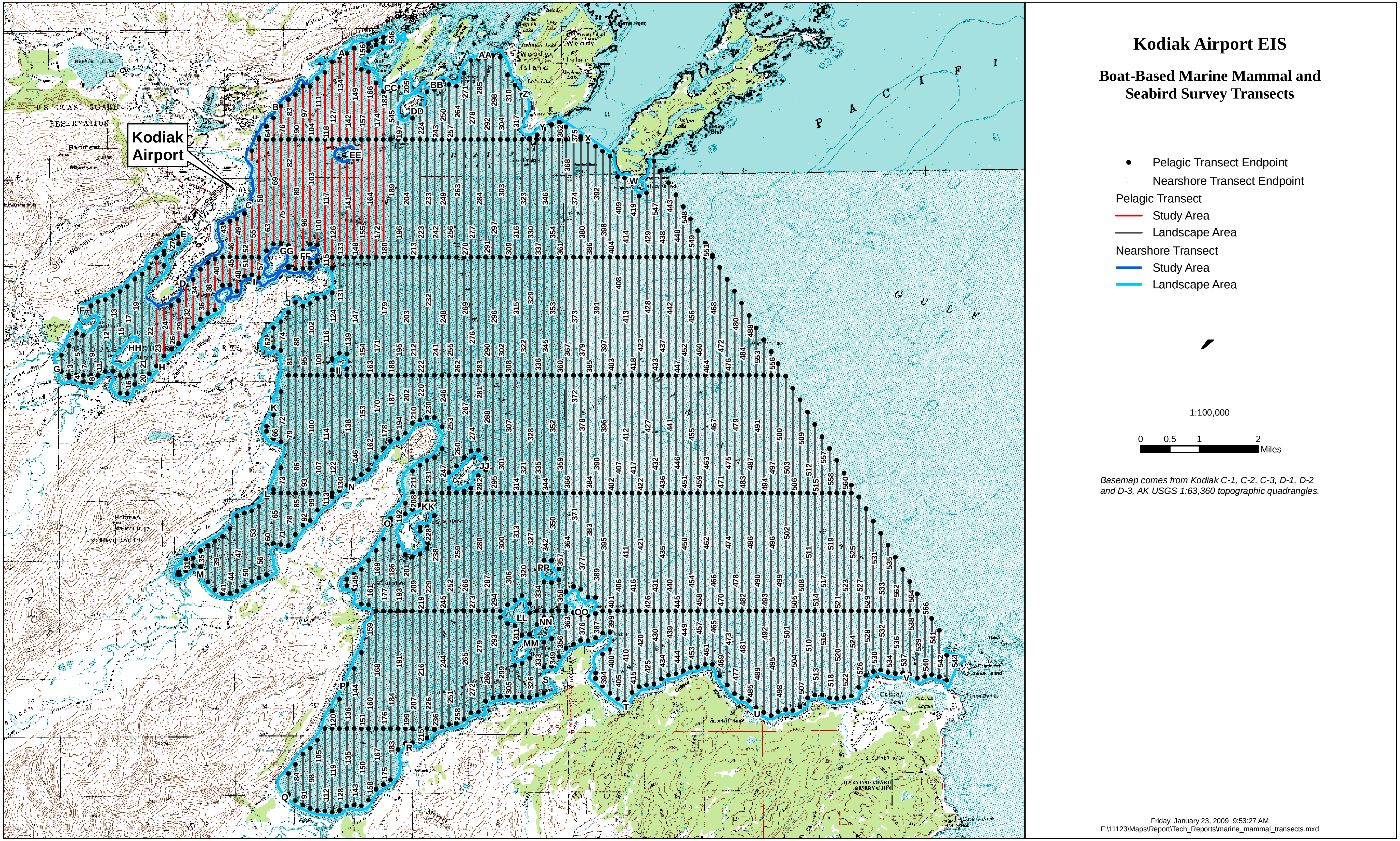

Figure 4. Chiniak Bay survey transects.

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In addition to the number of sea otters observed, their sex and age class was documented where possible. Environmental information on sea state, visibility, and glare was recorded throughout the survey on each data sheet. Surveys were not conducted if the weather conditions (i.e., wind of ≥20 knots or whitecaps) hindered visibility or safety of the crew. In addition to recording abundance, behavior, and disturbance on data sheets, the location of all marine mammal sightings was marked using a handheld Garmin GPS unit. These location data were cross-referenced with the information recorded on the data sheet.

3.2 Results

This section of the report provides a description of wildlife known to occur within the Study Area. The information provided below has been obtained from existing information, from the field survey efforts described above, and from input received from state and federal agency biologists and the public during scoping, subsequent conversations with agency biologists, and long-term field observations of EIS team members and others. Wildlife species observed within the Study and Landscape areas are described in four categories: general wildlife, high interest species, sensitive bird species, and marine mammals.

3.2.1 General Wildlife

The wildlife habitats located within the Study Area are based on the land cover types described in Section 2.2 of this report. Upland wildlife species, waterfowl, and seabirds that are common to and/or characteristic of these habitats are identified below. A comprehensive list of wildlife observed during field surveys or otherwise known to occur in the Study Area, their scientific names, season of occurrence, relative abundance, habitat affiliations, and conservation status is provided in Appendix C.

3.2.1.1 Sand and Gravel Beach

During the point-count surveys, wildlife species commonly observed using the Sand and Gravel Beach habitat within the Study Area included the American Pipit, American Wigeon, Bald Eagle, Black Oystercatcher, Black Turnstone, Black-legged Kittiwake, Common Raven, Emperor Goose, Glaucous-winged Gull, and Mew Gull.

3.2.1.2 Rocky Shore

Rocky Shore habitat within the Study Area was frequently observed being used by the Black Oystercatcher, Black Turnstone, Glaucous-winged Gull, Pelagic Cormorant, and Rock Sandpiper.

Harbor seals occasionally haul out on nearshore rocks in the Study Area, and northern sea otters were infrequently observed using these areas as well. A short-tailed weasel was observed in Rocky Shore habitat at the Airport in September 2007.

3.2.1.3 Elymus Grassland

Common or characteristic wildlife of this narrowly distributed habitat type are similar to those associated with immediately adjacent habitats, including Sand and Gravel Beach and Elymus Forb Meadow. Savannah Sparrows, Song Sparrows, and Black-billed Magpies were regularly observed using this habitat during the summer.

3.2.1.4 Elymus Forb Meadow

This habitat type is frequented year-round by the Common Raven, Northwestern Crow, and Black-billed Magpie. During spring and summer, songbird diversity increases and the Fox Sparrow, Savannah Sparrow, Orange-Crowned Warbler, Wilson's Warbler, and Yellow Warbler are commonly observed. This habitat type also provides habitat for tundra voles. Arctic ground squirrels were once present in Elymus Forb Meadow habitat within the Study Area, but they have apparently been extirpated from the Study Area for wildlife hazard management purposes.

3.2.1.5 Alder-Salmonberry-Elderberry

Common wildlife species found in this habitat type include the Black-billed Magpie, Hermit Thrush, Yellow Warbler, Song Sparrow, Wilson’s Warbler, and red fox. Where it occurs along the Buskin River, this habitat is also used by the brown bear for hiding cover and foraging for salmonberries.

3.2.1.6 Sitka Spruce Forest

Characteristic wildlife species found in this conifer forest habitat include the red squirrel, snowshoe hare, Black-capped Chickadee, Dark-eyed Junco, Orange-crowned Warbler, Hermit Thrush, Varied Thrush, and Pine Siskin.

3.2.1.7 Alder-Willow Mix

Common species to this habitat type include the Song Sparrow and the Golden-crowned Sparrow along with many of the same species that occur in the adjacent Sitka Spruce Forest, Alder-Salmonberry-Elderberry, and Rivers and Streams habitats.

3.2.1.8 Rivers and Streams

The Rivers and Streams habitat type includes aquatic and estuarine waters associated with the Buskin River and its tributaries. Rivers and streams within the Study Area support a variety of mammal species, including the beaver, river otter, and the Kodiak brown bear—which is commonly observed fishing along the Buskin River during salmon runs in the late summer and fall. A variety of bird species use riverine habitat within the Study Area. These include the American Dipper, which is common year-round, and the Belted Kingfisher. In slower moving waters, such as the Buskin River estuary, Mallards and Buffleheads are common in the spring, fall, and winter.

3.2.1.9 Disturbed Areas

Introduced Norway rats and feral cats may be associated with the Disturbed Areas cover type in the Study Area. In addition, native species such as the Common Raven and Black-billed Magpie are often seen around buildings and in other disturbed areas.

3.2.1.10 Freshwater Wetlands

Wildlife associated with Freshwater Wetlands cover type varies depending on the plant species composition and habitat structure of the wetland area. Freshwater Wetlands dominated by willows (such as those adjacent to the lower Buskin River) support the same wildlife species common to the Alder-Salmonberry-Elderberry, Alder Willow Mix, and Rivers and Streams cover types. Freshwater Wetlands cover type dominated by herbaceous grasses and forbs support wildlife communities more typical of the surrounding Elymus Forb Meadow cover type.

3.2.1.11 Sedge Marsh

Sedge Marsh cover type occurs in the intertidal zone of the Buskin River estuary. Consequently, wildlife use varies somewhat with tidal stage. Wildlife most commonly observed using estuarine waters and marsh vegetation at the mouth of the Buskin include Mallard, American Wigeon, Common Merganser, Bufflehead, and Common Goldeneye.

3.2.2 High Interest Species

High interest species are those that receive high levels of public attention and are, consequently, of high economic and/or social value. The species discussed below have been identified by the EIS team as high interest species based on input received during public and agency scoping. Concerns may be based on a species' popularity as watchable wildlife, controversy involving their management, their value as a game or subsistence species, or designation as a safety hazard for aircraft. Species granted special protection and/or recognition by state or federal law are identified in Sections 3.2.3 and 3.2.4.

3.2.2.1 Kodiak Brown Bear

The Kodiak brown bear is the largest native land mammal in the Archipelago. The island-wide population is estimated at roughly 3,000 bears (Barnes and Smith 1998). The Kodiak brown bear is of economic interest to Kodiak because it attracts both wildlife viewers and hunters to the island.

The Kodiak brown bear, like all brown bears, is an omnivore and is able to adapt to a wide variety of habitats. These bears generally hibernate during the winter, though there have been documented exceptions to this (VanDaele et al. 1989, VanDaele 2007). Kodiak brown bears studied in the Terror Lake area, the closest studied population to the Airport, generally went into hibernation around mid-November and began to emerge at the end of March (VanDaele et al. 1989, VanDaele 2007).

The Buskin River runs adjacent to the north side of the Airport. This drainage is one of the most productive salmon systems on the east side of the island, and although the exact number of bears (most likely between 6 and 12) using the lower Buskin River is not known, what is known is that the lower Buskin River provides a critical food resource to bears in the area (Lawrence Van Daele, ADFG Biologist, personal communication with Thomas Sharp, SWCA, March 31, 2008). The Kodiak brown bear would potentially utilize some of the habitats found within the Study Area, including Sitka Spruce Forest, Alder Willow Mix, Elymus Forb Meadow and Rivers and Streams.

The lower Buskin River is critical to bears that have achieved the fragile balance of surviving in close proximity to the main human population on the Archipelago. Because of this fine balance, any change in the salmon availability—a key food source for bears living in this area—is likely to result in an increase of bear/human encounters (Lawrence Van Daele, ADFG Biologist, personal communication with Thomas Sharp, SWCA, March 31, 2008). While brown bears are occasionally harvested for subsistence purposes on portions of Kodiak Island, it is unlikely that they are ever taken in the Landscape Area.

3.2.2.2 Sitka Black-tailed Deer

Sitka black-tailed deer were introduced to Kodiak Island from southeastern Alaska in the late 1800s and had dispersed throughout the Archipelago by the 1960s. The present population is estimated at 65,000 and is growing. Winter mortality is the most significant limiting factor for the deer population (Lawrence Van Daele, ADFG Biologist, personal communication with Thomas Sharp, SWCA, March 31, 2008). This species is of economic importance to the island because it draws hunters. Sitka black-tailed deer are commonly harvested for subsistence purposes within the Landscape Area.

Sitka black-tailed deer frequent the Study Area, especially in the winter. The Airport fence keeps most deer away from the runways, but some have strayed onto the airfield. Deer can often be seen in the area at the base of Barometer Mountain, just across Chiniak Highway from Runway End 25 (Lawrence Van Daele, ADFG Biologist, personal communication with Thomas Sharp, SWCA, March 31, 2008). Only one deer was observed during the Airport wildlife surveys. It was seen along the north bank of the Buskin River near the mouth of the river on January 29, 2008.

Important habitat for deer consists of an area with a mosaic of shrubs, trees, and open areas that they will use for escape cover, thermal protection, and foraging. Potential habitat for the sitka black-tailed deer does exist within the Study Area and consists mainly of the habitats that are continuous with the northern edge of the Study Area. The deer could use the Sitka Spruce Forest as thermal and escape cover; however, preferred habitat is found in the Alder Willow Mix and the Alder-Salmonberry-Elderberry habitats.

3.2.2.3 Bald Eagle

The Bald Eagle is the most commonly seen raptor species in the Study Area and on Kodiak Island as a whole (USDA 2000). The breeding population for the island is estimated to be at 1,000 eagles (Lawrence Van Daele, ADFG Biologist, personal communication with Thomas Sharp, SWCA, March 31, 2008), with roughly 19 nests found in the Chiniak Bay watershed area (NOAA 1997). Approximately 3,000 Bald Eagles are thought to winter on the islands (Lawrence Van Daele, ADFG Biologist, personal communication with Thomas Sharp, SWCA, March 31, 2008). Bald Eagles were observed regularly throughout the year during the Airport point-count surveys. Although observed from all 13 of the Airport point-count stations, Bald Eagles were most commonly seen perched in trees along the Buskin River during that survey effort.

Bald Eagles are considered scavengers and predators. Their main food source is dead or dying fish, but they will also kill birds and small mammals. Because Bald Eagles are aerial hunters, their foraging patterns are widespread. They will forage throughout the majority of the habitats in the Study Area, concentrating on habitats that support their main prey, such as the Rocky Shore, Rivers and Streams, Elymus Forb Meadow, and Sitka Spruce Forest habitats.

3.2.2.4 Arctic Ground Squirrel

The Arctic ground squirrel was most likely introduced to Kodiak by the Alutiiq peoples thousands of years ago (Burris and McKnight 1973). Some consider the Kodiak population to be a unique subspecies of the arctic ground squirrel. On Kodiak Island, they were only known to occur on the Airport infields and lawns within the adjacent Coast Guard property. Arctic ground squirrels also occur on Chirikof Island, the southernmost island of the Archipelago. Arctic ground squirrels have apparently been eradicated from the Airport. Several years ago, in accordance with recommendations in the WHA (USDA 2000), Alaska Department of Transportation and Public Faculties initiated a program to reduce or eliminate ground squirrels from the airfield for wildlife hazard management purposes. Because no ground squirrels were observed on the airfield during the Airport point-count surveys, it appears that Airport management was successful in this eradication effort. Arctic ground squirrels may still persist on the Coast Guard Base, where they have been known to be concentrated on the lawn near the Coast Guard’s "Golden Anchor" meeting hall (Lawrence Van Daele, ADFG Biologist, personal communication with Thomas Sharp, SWCA, March 31, 2008). Potential habitat for the Arctic Ground Squirrel consist of the Elymus Forb Meadow.

3.2.2.5 American Beaver

The American beaver was introduced to Kodiak in 1925 (Burris and McKnight 1973). Beavers can occasionally be found in the lower Buskin River or in Devils Creek. These beavers tend to be "bank beavers" and do not build dams on the main river (Lawrence Van Daele, ADFG Biologist, personal communication with Thomas Sharp, SWCA, March 31, 2008). Beaver are trapped for subsistence purposes within the Landscape Area. The Buskin River is potential habitat for the American beaver.

3.2.2.6 Snowshoe Hare

The snowshoe hare is another small mammal species that has been introduced to Kodiak Island. They feed on a variety of plant material including grasses, buds, and leaves in the spring and summer. In the winter, spruce needles, twigs, and bark and the buds of willows comprise the majority of their diet. Snowshoe hares were observed in Sitka Spruce Forest (point B13) during the Airport point-count surveys. Snowshoe hares will also forage in brushy habitats such as the Alder-Salmonberry-Elderberry and Alder Willow Mix habitats. Snowshoe hares are one of the most commonly harvested subsistence species in the Landscape Area.

3.2.2.7 Chiniak Bay Seabirds, Shorebirds, and Waterfowl

Chiniak Bay has been identified by the National Audubon Society as an Important Bird Area (IBA). The Alaska IBA technical committee has identified three IBAs in the Archipelago, including Chiniak Bay, Northwest Afognak Island, and Uganik Bay/Viekoda Bay. Of these, Chiniak Bay is the only IBA of global significance. An IBA is defined by the Audubon Society as "a site that provides essential habitat for one or more species of bird. IBAs include sites for breeding, wintering, and/or migrating birds. IBAs may be a few acres or thousands of acres, but are usually discrete sites that stand out from the surrounding landscape (Audubon 2005)."

Chiniak Bay is home to 26 bird colonies that are active from spring through the fall. The following species make up these nesting colonies: Black-legged Kittiwake, Double-crested Cormorant, Black Oystercatcher, Glaucous-winged Gull, Pelagic Cormorant, Red-faced Cormorant, Mew Gull, Arctic Tern, Common Murre, Tufted Puffin, Horned Puffin, Pigeon Guillemot, and Aleutian Tern (NOAA 1997). Additionally, during the spring and fall, the inner bays of Chiniak Bay are important waterfowl concentration zones, and during the winter, most of Chiniak Bay is an important waterfowl concentration zone (NOAA 1997). Additional information on seabirds and waterfowl in the Study and Landscape areas is provided below.

This section outlines birds that regularly occur in the aquatic and estuarine habitats, and coastal, nearshore, and pelagic marine habitats in and around Chiniak Bay. To facilitate description, birds have been grouped based on taxonomic relationships and/or habitat or foraging guilds. These groups are: dabblers, divers, pelagic birds, gulls and terns, shorebirds, and alcids. Below are short descriptions of each of these groups. Some of these species are federally listed under the Endangered Species Act (ESA), or are considered species of concern by the USFWS and/or the State of Alaska. These species are treated in greater depth in the subsequent section on sensitive bird species. Appendix C lists birds known to occur in the Study Area and indicates their relative abundance by season.

3.2.2.7.1 Dabblers

Dabblers are waterfowl, such as ducks, swans, and geese that feed on floating or submerged aquatic vegetation, grass, or insects. Although dabblers are usually associated with fresh water ponds, puddles, and wetlands, they are also found in nearshore marine waters, especially during migration. Up to 13 species of dabblers may be found in nearshore environment of Chiniak Bay and Buskin River Estuary at various times throughout the year. The Emperor Goose and Mallard are common in the spring, fall, and winter. Mallards are less common but are about the only dabbler regularly present in the area during the summer. Other dabblers that may be present in the spring, albeit in lower numbers or in larger, unevenly distributed groups, include Tundra Swan, Gadwall, American Wigeon, Northern Shoveler, and Northern Pintail. Gadwalls and American Wigeons are uncommon to rare during the fall and winter. The Greater White-fronted Goose and Northern Shoveler occur in the Study Area on a rare and uncommon basis, respectively, during the spring. Other dabblers such as the Eurasian Wigeon, Northern Pintail, and Green-winged Teal occur in relatively small numbers in the spring, fall, and winter (MacIntosh 2008). Canada Geese are considered rare in the spring and fall and only six individuals were observed during the EIS field surveys; these individuals were seen at the head of Women's Bay. Several dabblers, particularly mallards, wigeons, teal, and Canada geese are regularly taken for subsistence purposes in the Study Area (in and over nearshore waters and the Buskin River estuary) and marine Landscape Area.

3.2.2.7.2 Divers

This group consists of various aquatic and marine birds that dive or dip underwater to obtain food such as small fish and marine or aquatic invertebrates. For the purposes of this analysis, divers consist of loons, grebes, cormorants, and diving ducks. Marine habitats are used by divers for feeding and roosting. Harlequin Ducks, Black Scoters, Common and Red-breasted Mergansers, and Pelagic Cormorants are present in the area year-round. Harlequin Ducks and mergansers are common in the spring, fall, and winter and uncommon in the summer. The Black Scoter is abundant in the spring, fall, and winter and rare in the summer. Pelagic Cormorants are common year-round. Other divers that may occur in large numbers or in smaller or less evenly spaced groups in the spring, fall, and summer include Greater Scaup, Steller's Eider, Common Eider, Surf Scoter, White-winged Scoter, Long-tailed Duck, Bufflehead, Common Goldeneye, Common Loon, Horned Grebe, Red-necked Grebe, and Double-crested Cormorant (MacIntosh 2008). A variety of divers are taken for subsistence purposes in the upland and marine Study Areas and the marine Landscape Area. These include the Bufflehead, Common Goldeneye, Harlequin Duck, Long-tailed Duck, as well as scaups, scoters, and mergansers.

3.2.2.7.3 Pelagic Birds

Pelagic birds include long-winged seabirds such as albatrosses, shearwaters, and storm petrels. Birds in this group feed at or just below the water’s surface and rarely come close to shore, except to breed. Pelagic birds are found in areas where prey (e.g. fish, squid, aquatic invertebrates, and/or offal) are concentrated, typically in waters near the edge of the continental shelf and submerged slopes. Pelagic birds do not normally occur in the shallow nearshore habitats found within the Study Area. However, they may occur in deeper portions of Chiniak Bay and the Gulf of Alaska waters beyond the bay. Eight species of pelagic birds are known to regularly occur in the Archipelago and consist of Laysan and Black-footed Albatrosses, Northern Fulmar, Mottled Petrel, Sooty and Short-tailed Shearwaters, and Fork-tailed and Leach's Storm Petrels. Of these, the Northern Fulmar is present year-round, abundant in the spring, summer, and fall, and is common in the winter. The Fork-tailed Storm Petrel is also present throughout the year and is common in the spring, summer, and fall, and is uncommon in the winter. The other species listed range from uncommon to common during the spring, summer, and fall, and are absent or accidental in the winter (MacIntosh 1998).

3.2.2.7.4 Gulls and Terns

In addition to gulls and terns, this group includes kittiwakes and jaegers, the latter of which are oceanic birds that come to land only to nest. At sea, jaegers obtain most of their food by piracy, chasing other seabirds, and forcing them to drop their captured prey. On their breeding grounds, jaegers prey on small mammals and birds. Gulls are found in a variety of open upland, aquatic, and marine habitats. They are opportunistic omnivores and appear to be equally adept at flying, swimming, and walking. Kittiwakes are small, colonial, cliff-nesting gulls that feed on fish, aquatic invertebrates, and offal. Terns are generally smaller than gulls and feed almost exclusively on small fish captured by plunge-diving. Three species of jaeger: the Pomarine Jaeger, Parasitic Jaeger, and Long-tailed Jaeger are known to occur in the Kodiak area in the spring, summer, and fall (MacIntosh 1998) and may occur in Chiniak Bay. Six species of gulls frequent the Study Area, including: the Mew Gull, Herring Gull, Thayer’s Gull, Glaucous-winged Gull, Glaucous Gull and Black-legged Kittiwake. Of these, the Mew and Glaucous-winged gulls are abundant in the area year-round and are frequently observed foraging in intertidal and shallow subtidal zone adjacent to the Airport and loafing on the Buskin River barrier bar. The kittiwake, which has a nesting colony outside of the Study Area between the Airport and Kodiak Harbor, forages in somewhat deeper nearshore waters by the Airport and is abundant in the spring, summer, and fall and is rare in the winter (MacIntosh 2008).

3.2.2.7.5 Shorebirds

Shorebirds comprise a large and varied group of slender, long-legged birds that occur in aquatic and marine shore habitats where they forage for invertebrates by picking or probing intertidal substrates with their bills. Seventeen species of shorebirds are known to occur in the Study Area and an additional 14 species are known to occur in the Archipelago on a fairly regular basis (MacIntosh 1998, 2008). A few species occur in the Study Area year-round. These species include the Black Oystercatcher, Black Turnstone, Surfbird, and Rock Sandpiper. Other species, including the Pacific Golden-Plover, Semipalmated Plover, and Wilson's Snipe are present in the spring, summer, and fall. Greater Yellowlegs, Wandering Tattlers, and Western and Least Sandpipers occur only in the spring and summer. Several species, including Lesser Yellowlegs, Spotted Sandpiper, Whimbrel, Ruddy Turnstone, Baird's Sandpiper, and Dunlin, occur in the Study Area in small numbers during spring migration.

3.2.2.7.6 Alcids

Alcids are short-tailed, short-necked oceanic birds that come to land only to nest. They eat fish and marine invertebrates, often crustaceans, which they capture by diving and by using their short wings to "fly" underwater in pursuit of prey. A variety of alcids use open water habitats in Chiniak Bay, and several nest on small islands and other upland habitats in the area. Five alcid species, the Common Murre, Pigeon Guillemot, Marbled Murrelet, Horned Puffin, and Tufted Puffin, are known to occur in the eastern, marine portions of the Study Area. The Pigeon Guillemot and Marbled Murrelet occur in the area regularly throughout the year, with the former occurring in relatively large numbers and the latter in relatively small numbers. Common Murres occur in small numbers in the spring, fall, and winter, and the puffins are present in small numbers or unevenly distributed larger numbers in the spring, summer, and fall (MacIntosh 2008).

3.2.3 Sensitive Bird Species

The sensitive bird species included in this report include one federally listed threatened species and several species considered by the Alaska Department of Fish and Game (ADF&G) to be species of special concern (ADF&G 1998). Certain bird species on the Alaska WatchList (Audubon 2005) known to occur in the upland or marine Landscape Area are also evaluated here. The Alaska WatchList identifies birds at risk due to population decline, small population size, limited geographic range, and threats to breeding or wintering habitats or migratory stopovers. It identifies species that deserve focused monitoring and research. The Audubon Nationwide WatchList is similar to the Alaska WatchList, but is at a broader geographical scale. These species, their status, a brief description of the range of habitat requirements, and known and/or suspected uses of the Study Area are presented below.

3.2.3.1 Peregrine Falcon

The Peregrine Falcon (*Falco peregrinus*) is listed by the ADF&G and is on the Alaska WatchList. There are two subspecies that can occur near the Study Area, the American Peregrine Falcon (*F. peregrinus anatum*) and the Arctic Peregrine Falcon (*F. peregrinus tundrius*). The American Peregrine nest throughout the forested interiors, usually on cliffs associated with rivers or lakes. The Arctic Peregrine nests on the ground in tundra habitat. Both subspecies use a wide range of habitats for foraging.

This species has been known to move through the Study Area (Lawrence Van Daele, ADFG Biologist, personal communication with Thomas Sharp, SWCA, March 31, 2008). It is most often observed in the riparian area around the Buskin River, though it can potentially forage in any of the habitats within the Study Area. A single falcon was observed in flight near the end of Runway End 25 in October of 2008 during the Airport point-count surveys. It is unknown whether this was an Arctic or an American Peregrine Falcon.

3.2.3.2 Northern Goshawk

The Northern Goshawk (*Accipiter gentilis*) is listed by the ADF&G and is on the Alaska WatchList. This species uses coniferous and mixed deciduous/coniferous forests for nesting and foraging, though it can be occasionally seen in the riparian areas as well. This species has been known to move through the Study Area (Lawrence Van Daele, ADFG Biologist, personal communication and Thomas Sharp, SWCA, March 31, 2008). A Goshawk plucking perch has also been observed in the coniferous forest habitat of the Study Area. Northern Goshawks were observed in the Study Area during the WHA surveys in 1999–2000, but none were observed during the Airport EIS point-count surveys.

3.2.3.3 Olive-sided Flycatcher

The Olive-sided Flycatcher (*Contopus cooperi*) is listed by the ADF&G and is on the Alaska WatchList as well as the Audubon Nationwide WatchList. This species nests almost exclusively on conifer limbs, though it can occasionally be found in mixed deciduous/coniferous forest. The Olive-sided Flycatcher is often associated with forest openings and water. It needs abundant insect resources and canopy openings for hawking these resources. It is considered an indicator species of the coniferous forest biome. Although potentially suitable habitat for this species exists in the Study Area, Olive-sided Flycatchers were not observed during the WHA surveys or during the EIS point-count surveys described above.

3.2.3.4 Steller’s Eider

The Steller's Eider (*Polysticta stelleri*) is a federally listed threatened species, an ADF&G species of special concern, and is on the Alaska WatchList and the Audubon Nationwide WatchList. Of the four eider species found in Alaska, Steller’s Eider is the smallest. It is a diving duck, feeding mostly in marine habitats in the winter and freshwater ponds during breeding (Quakenbush 2008). The Steller’s Eider diet consists of small marine invertebrates, mollusks, crustaceans, echinoderms, and small fish. Most of its life is spent on the water, with a brief nesting period in the northern Alaskan tundra.

There are three breeding populations of this species globally: two are located in Russia and one in Alaska. The Alaskan breeding population nests on the Arctic Coastal Plain near Barrow and Prudhoe Bay, and on the Yukon-Kuskokwim River Delta in western Alaska (USFWS 2002). After breeding, from July through October, Steller’s Eiders concentrate in large numbers in marine waters near the Alaska Peninsula to undergo a complete molting. Afterward, they disperse to wintering grounds along the Aleutian Islands, the Alaska Peninsula, Kodiak Island, and southern Cook Inlet. In the winter, Steller’s Eiders remain in marine habitats usually less than 10 m deep and less than 400 m from shore (USFWS 2002).

Alaska’s breeding population of Steller’s Eider was listed as a threatened species in 1997 (62 FR 31748). Critical habitat for the breeding population was designated in 2001 and is located in the Bering Sea and Yukon-Kuskokwim delta (66 FR 8849). A recovery plan was published in 2002 (USFWS 2002), documenting threats and actions needed for recovery.

Kodiak Island provides important wintering habitat for this species. Steller’s Eider can found in high numbers in various parts of the island, including Chiniak Bay. Counts of wintering Steller’s Eiders were conducted by the USFWS and Kodiak National Wildlife Refuge in late January of 1994, 2001, and 2002. These counts produced the following Chiniak Bay Steller’s Eider totals, respectively: 2,024; 823; and 1,318 (Larned and Zwiefelhofer 2001, 2002). In 2001 a concentration of 30 birds was observed in the area offshore of the Airport (Larned and Zwiefelhofer 2001). In 2002 a concentration of 450 birds was observed offshore of the Airport and in the eastern portion of Women’s Bay (Larned and Zwiefelhofer 2002). During SWCA’s coastal bird counts conducted on the Airport from November 2007 to October 2008, the largest number of individual Steller's Eiders observed in a single day (combined results for each of the coastal points) was 1,075 on January 18, 2008. Nearly all of these birds were greater than 1,200 ft from the point-count station.

Overall the Airport point-count surveys resulted in a combined total of 3,876 Steller’s Eider observations. Approximately 90 of these observations were made in the fall. Except for a few individuals observed during the spring, the vast majority of the Steller's Eiders detected during the Airport point counts were observed during the winter, and the majority of these individuals were seen greater than 1,200 feet from the current runway ends. Of the Steller's Eiders observations made during the point-count surveys, most were located off Runway End 18 (1,048 observations) and Runway End 36 (1,306 observations). Boat-based surveys of Chiniak Bay resulted in a total of 1,491 Steller's Eider observations, 1,372 of these occurred in February 2008, whereas the remaining 119 observations were made in September 2008. No Steller's Eiders were observed during the May 2008 surveys. Nearly 200 Steller's Eiders were observed in nearshore waters from St. Paul Harbor to the southern end of the Nyman Peninsula during the February boat-based survey; 85 of these observations were from waters immediately offshore of the Airport. Other areas in which Steller's Eiders were concentrated during the February boat survey included nearshore waters along southeastern side of Womens Bay and the Blodgett Island-Zaimka Island area 1 to 2 miles southeast of the Airport. Over 660 birds were observed in this area at that time. Another area of concentration was the Svitlak-Middle-Kekur Island-Isthmus Point area near the mouth of Kalsin Bay. Approximately 280 Steller's Eiders were observed in this area during the February survey.

Table 3 summarizes the results of the Airport point-count survey results for Steller's Eider observed from the four coastal point-count stations located at Runway Ends 18, 25, 29, and 36. As shown in the table, the vast majority of Steller's Eiders were observed during the winter at distances greater than 1,200 feet from the current runway end, i.e., beyond the area that would be directly affected by the runway safety area expansion alternatives. Fewer Steller's Eiders, but still a considerable number, were observed in the 400 feet to 800 feet and 800 feet to 1,200 feet distance categories, areas that could be directly affected by the RSA alternatives.

Table 3. Summary of Sensitive Seabird Observations in the Study Area

Runway End	Season	Distance from Runway End	Species Counts		
			Steller's Eider	Emperor Goose	Black Oystercatcher
18	Fall	< 400 feet	0	0	0
		400 feet– 800 feet	0	0	0
		800 feet–1,200 feet	0	0	0
		> 1,200 feet	0	0	0
	Winter	< 400 feet	0	2	23
		400 feet–800 feet	80	0	2
		800 feet–1,200 feet	250	250	50
		> 1,200 feet	928	62	0
	Spring	< 400 feet	0	0	3
		400 feet–800 feet	0	0	0
		800 feet–1,200 feet	0	0	0
		> 1,200 feet	0	0	0
	Summer	< 400 feet	0	0	0
		400 feet–800 feet	0	0	0
		800 feet–1,200 feet	0	0	0
		> 1,200 feet	0	0	0
25	Fall	< 400 feet	0	0	13
		400 feet–800 feet	0	0	0
		800 feet–1,200 feet	0	0	0
		> 1,200 feet	50	0	26
	Winter	< 400 feet	1	2	181
		400 feet–800 feet	23	45	138
		800 feet–1,200 feet	54	206	60
		> 1,200 feet	604	160	0
	Spring	< 400 feet	0	0	0
		400 feet–800 feet	0	0	6
		800 feet–1,200 feet	0	0	18
		> 1,200 feet	4	0	0
	Summer	< 400 feet	0	0	0
		400 feet–800 feet	0	0	1
		800 feet–1,200 feet	0	0	5
		> 1,200 feet	0	0	10

Table 3. Summary of Sensitive Seabird Observations in the Study Area

Runway End	Season	Distance from Runway End	Species Counts		
			Steller's Eider	**Emperor Goose**	**Black Oystercatcher**
29	Fall	< 400 feet	0	0	2
		400 feet–800 feet	3	45	0
		800 feet–1,200 feet	0	0	0
		> 1,200 feet	0	210	0
	Winter	< 400 feet	68	73	70
		400 feet–800 feet	33	32	50
		800 feet–1,200 feet	38	355	0
		> 1,200 feet	1,137	0	0
	Spring	< 400 feet	0	0	5
		400 feet–800 feet	5	0	0
		800 feet–1,200 feet	0	0	0
		> 1,200 feet	21	0	0
	Summer	< 400 feet	0	0	0
		400 feet–800 feet	0	0	0
		800 feet–1,200 feet	0	0	0
		> 1,200 feet	0	0	0
36	Fall	< 400 feet	0	0	0
		400 feet–800 feet	0	0	0
		800 feet–1,200 feet	0	0	0
		> 1,200 feet	35	26	35
	Winter	< 400 feet	0	0	5
		400 feet–800 feet	25	0	0
		800 feet–1,200 feet	134	0	0
		> 1,200 feet	592	284	103
	Spring	< 400 feet	0	0	0
		400 feet–800 feet	0	0	0
		800 feet–1,200 feet	0	0	0
		> 1,200 feet	0	0	4
	Summer	< 400 feet	0	0	0
		400 feet–800 feet	0	0	0
		800 feet–1,200 feet	0	0	0
		> 1,200 feet	0	0	0

Source: SWCA Airport Point-count Surveys 2007–2008

Data from the boat-based surveys was used to estimate Steller's Eider densities in the four different survey strata described in Section 3.1.3. From the counts made during each survey event, seabird densities were calculated for each survey stratum. The average densities of Steller's Eider by stratum are presented in Table 4. Eider density was calculated for each transect surveyed (see calculation below). Density of a given transect = number of eiders observed per given transect area. These densities were then summed and divided by the total area surveyed to determine the average eider density per km^2 for the Study Area. Using this method, it was possible to assess the variance in eider density between transects, strata, and sample periods.

a = individual transect area

n = number of transects surveyed

N = number of individual Eiders observed in a transect area

d = density of eiders observed in a given transect area

D = average density of eiders observed per km^2 of the Study Area

$$d = \frac{N}{a}$$

$$D = \frac{\sum d}{n}$$

Table 4. 2008 Steller's Eider Densities Adjacent to the Study Area

Survey Stratum	Survey Month		
	February (eiders/km²)	May (eiders/km²)	September (eiders/km²)
Study Area Nearshore	156.64 (std err = 63.43)	0	22.87 (std err = 21.78)
Landscape Area Nearshore	41.42 (std err = 17.87)	0	0.65 (std err = 0.65)
Study Area Pelagic	12.77 (std err = 8.64)	0	0
Landscape Area Pelagic	7.49 (std err = 3.89)	0	0

The density of Steller's Eiders observed in the Study Area Nearshore stratum in February is significantly greater than the number observed in the other three strata ($t = 2.01$, $p < 0.001$ for each t-test). The density of Steller's Eiders observed in the Study Area Nearshore stratum in September is also significantly greater than the number observed in the other three strata ($t = 2.00$, $p < 0.02$ for each t-test).

3.2.3.5 Emperor Goose

The Emperor Goose (*Chen canagica*) is on the Alaska WatchList as well as the Audubon Nationwide WatchList. It breeds in northern Alaska. Most of the world's population winters in the Aleutian Islands, with some wintering near the Alaska Peninsula and on Kodiak Island (Petersen et al. 1994). This Emperor Goose diet consists of vegetation and invertebrates. The Emperor Goose is common to the Study Area during the spring, fall, and winter (MacIntosh 2008). During the Airport point-count surveys, Emperor Goose were particularly abundant in the fall and winter, when flocks of up to 250 individuals were regularly observed on the beach and in nearshore waters off of Runway Ends 18, 25, and 29. Emperor Geese observed off of Runway End 36 were generally over 2,000 feet from the runway end and were using rocky intertidal and reef habitats.

Table 3, above, shows the number of Emperor Goose observations made from coastal point-count stations during the Airport point-count surveys. Similar to the Steller's Eider, the majority of Emperor Goose observations were in the winter at distances greater than 1,200 feet from the runway ends. No Emperor Geese were observed in the Study Area during the spring and summer.

Data from the boat-based surveys was used to estimate densities of Emperor Geese observed in the four survey strata in the marine Study Area and Landscape Area. These densities were calculated in the same way as those described above for Steller's Eider. Emperor Goose densities observed during the boat-based surveys are presented in Table 5. The methodology used to calculate Emperor Goose densities is available in Section 3.2.3.4 Steller's Eider.

Table 5. 2008 Emperor Goose Densities Adjacent to the Study Area

Survey Stratum	Survey Month		
	February (geese/km²)	May (geese/km²)	September (geese/km²)
Study Area Nearshore	5.14 (std err = 4.23)	0	0
Landscape Area Nearshore	45.15 (std err = 32.62)	0	0
Study Area Pelagic	0	0	0
Landscape Area Pelagic	0	0	0

Although Table 5 indicates that a greater density of Emperor Geese was observed in nearshore waters in the Landscape Area than in nearshore waters in the Study Area, the difference in estimated densities was not statistically significant. The lack of a significant difference in these figures is likely due to the high variance (as indicated by the large standard errors) in densities between transects.

3.2.3.6 Black Oystercatcher

The Black Oystercatcher (*Haematopus bachmani*) is on the Alaska WatchList as well as the Audubon Nationwide WatchList. Black Oystercatchers can be found in Rocky Shore habitat and adjacent intertidal flats. They feed primarily on bivalves and other mollusks as well as crabs, sea urchins, isopods and barnacles. They are typically found where this food source is present. This species has been known to gather in flocks of up to 600 birds in Chiniak Bay. This represents 7% of the global population (Iain J.

Stenhouse, Audubon Director of Bird Conservation, scoping letter to Leslie A. Grey, FAA on April 6, 2007). This species also uses the mouth of the Buskin River to forage. Black oystercatchers are common in the Study Area throughout the year.

Table 3, above, presents the number of Black Oystercatcher observations made from coastal point-count stations during the Airport point-count surveys. Although Black Oystercatchers are present in the Landscape Area year-round, they were considerably more abundant in the Study Area during the winter months. When present, Black Oystercatchers were often observed in the shorter distance categories characteristic of the Rocky Shore habitat and intertidal areas in which they forage.

Black Oystercatcher densities estimated from the boat-based survey data are presented, by survey stratum, in Table 6. The methodology used to calculate Black Oystercatcher densities is available in Section 3.2.3.4 Steller's Eider.

Table 6. 2008 Black Oystercatcher Densities in the Study Area and Landscape Area

Survey Stratum	Survey Month		
	February (catchers/km²)	May (catchers/km²)	September (catchers/km²)
Study Area Nearshore	22.66 (std err = 12.32)	5.11 (std err = 4.59)	27.22 (std err = 27.01)
Landscape Area Nearshore	16.54 (std err = 13.74)	3.41 (std err = 1.67)	45.23 (std err = 33.99)
Study Area Pelagic	2.00 (std err = 2.00)	0	3.23 (std err = 3.01)
Landscape Area Pelagic	0	0.72 (std err = 0.57)	0.30 (std err = 0.18)

As shown in Table 6, a greater average density of Black Oystercatchers was observed in the Nearshore strata than in the Pelagic strata in February, but the difference was not statistically significant at the $p < 0.05$ level.

The densities of Black Oystercatchers estimated for the Landscape Area Nearshore and Study Area Nearshore strata in May were significantly greater than the densities in the Study Area Pelagic stratum ($t = 2.00$, $p = 0.04$ and 0.04 respectively). In May, greater Black Oystercatchers densities were observed in the Landscape Area Nearshore and Study Area Nearshore strata than in the Landscape Area Pelagic stratum, but the differences were not statistically significant at the $p < 0.05$ level ($t = 2.00$, $p = 0.06$ and 0.07 respectively).

For September, the density of Black Oystercatchers observed in the Landscape Area Nearshore stratum was significantly greater than the density observed in the Landscape Area Pelagic stratum ($t = 2.00$, $p = 0.03$). Similarly, a higher density of Black Oystercatchers was observed in the Landscape Area Nearshore stratum than in the Airport Pelagic stratum, but the difference was not statistically significant at the $p < 0.05$ level ($t = 2.00$, $p = 0.06$).

3.2.3.7 Red-Faced Cormorant

The Red-Faced Cormorant (*Phalacrocorax urile*) is on the Alaska WatchList as well as the Audubon Nationwide WatchList. Within the Landscape Area, the Red-faced Cormorant nests colonially in Rocky Shore habitat and on cliffs. Although the Red-faced Cormorant may forage far out to sea, it usually does so in shallow waters. It can be found year-round from Prince William Sound to Kodiak Island, the Alaskan Peninsula, and the Aleutian Islands (Causey 2002).

This species is one of ten regularly breeding sea bird species in Chiniak Bay (Iain J. Stenhouse, Audubon Director of Bird Conservation, scoping letter to Leslie A. Grey, FAA, April 6, 2007). There is suitable foraging habitat for this species in the marine waters of the Landscape Area and portions of the Study Area. There is nesting habitat on rocky headlands and islands of Chiniak Bay. A total of 29 observations of Red-faced Cormorants were made during the boat-based survey effort. Sixteen were observed in May and 13 were observed in September. The majority of these observations were made from the Broad Point - Queer Island - Kalsin Island area near the mouth of Kalsin Bay, indicating the likely presence of a nesting colony in this area. Red-faced Cormorants were not observed during land-based Airport surveys and were not seen during the WHA surveys (USDA 2000); it is unlikely that this species occurs in the Study Area on a regular basis.

3.2.3.8 Aleutian Tern

The Aleutian Tern (*Sterna aleutica*) is on the Alaska WatchList. The Aleutian Tern breeds on flat vegetated islands, tundra, meadows, and sandy spits. Breeding colonies are on many parts of the Alaskan coast, including Kodiak Island (North 1997). It migrates over 12,000 miles to the Antarctic to winter.

This species is one of ten regularly breeding sea bird species in Chiniak Bay (Iain J. Stenhouse, Audubon Director of Bird Conservation, scoping letter to Leslie A. Grey, FAA, April 6, 2007). Though the Buskin River barrier bar and other beaches in the vicinity of the Airport may provide potentially suitable nesting habitat for this species, no Aleutian Terns were observed during the Airport point-count surveys, the boat-based surveys of Chiniak Bay, nor during surveys conducted for the WHA (USDA 2000).

3.2.3.9 Kittlitz’s Murrelet

The Kittlitz’s Murrelet (*Brachyramphus brevirostris*) is a small and elusive diving bird that lives year-round in coastal Alaska and the Russian Far East. It is also known to winter in Canada’s Northwest Territories. The majority of its breeding habitat occurs in Alaska (USFWS 2007). It is thought to nest on unvegetated scree fields, coastal cliffs, barren ground, and rock ledges in remote areas. Nesting and foraging habitat is located close to marine waters, often near tidewater glaciers. Habitat availability is critical because the species relies mostly on a fish diet. However, it has been suggested that Kittlitz's Murrelets are not exclusively associated with glaciers (Stenhouse et al. 2008). The species is thought to move off shore into less sheltered waters for the winter. It has been listed by the USFWS as a Candidate species since 2004 (USFWS 2007).

During the breeding season, the largest counts and most frequent records of Kittlitz's Murrelets have been from the waters around Woody and Long Islands in northern Chiniak Bay; hatch-year juveniles have also been recorded in this area, indicating that this species breeds in the area (Stenhouse et al. 2008). In 2006, a single Kittlitz’s Murrelet nest was found on Kodiak Island, confirming that this species breeds on the island (Stenhouse et al. 2008). During the non-breeding season, Kittlitz's Murrelets have been observed in the upper reaches of Kodiak Island's fjords. Similar to the breeding season, the largest numbers from the east side of the island have been recorded around Chiniak Bay's northern islands (Stenhouse et al. 2008). An analysis of known breeding sites was done and extrapolated to the Kodiak Archipelago (Stenhouse et al. 2008). This analysis identified potentially suitable breeding habitat west of Chiniak Bay along the mountainous spine of the Archipelago (Stenhouse et al. 2008). No Kittlitz's Murrelets were observed during the WHA or EIS field surveys.

3.2.4 Marine Mammals

A variety of marine mammals occur in Chiniak Bay, but the mostly shallow water immediately adjacent to the Airport likely prevents much use of the Study Area by the larger marine mammals. The following section describes marine mammals known to occur in the Landscape Area, including sightings within the Study Area. All marine mammals are protected by the Marine Mammal Protection Act (MMPA) of 1972, as amended. Several marine mammals are also protected under the ESA of 1973, as amended. Table 7 lists marine mammals known to occur or with potential to occur in the Study Area and Landscape Area and their current conservation status.

Table 7. Marine Mammals Known to Occur in or near Chiniak Bay

Common Name	Scientific Name	Stock	Status[1]	Occurrence[3]
Northern Sea Otter	*Enhydra lutris kenyoni*	SW Alaska DPS[2]	T	SA, LA
Steller Sea Lion	*Eumetopias jubatus*	Western	E	LA
Harbor Seal	*Phoca vitulina*	Gulf of Alaska	NL	SA, LA
Harbor Porpoise	*Phocoena phocoena*	Gulf of Alaska	NL	LA
Dall's Porpoise	*Phocoenoides dalli*	Alaska	NL	LA
Killer Whale - Resident	*Orcinus orca*	Alaska Resident	NL	LA
Killer Whale - Transient	*Orcinus orca*	Gulf of Alaska Transient	NL	LA
Cuvier's Beaked Whale	*Ziphius cavirostris*	Alaska	NL	U
Gray Whale	*Eschrichtius robustus*	Eastern North Pacific	NL	U
Fin Whale	*Balaenoptera physalus*	Northeast Pacific	E	LA
Humpback Whale	*Megaptera novaeangliae*	Central North Pacific	E	LA

[1]E = Endangered; T= Threatened; NL=Not Listed; [2]DPS = Distinct Population Segment; [3]SA = Observed within Study Area, LA = Observed within Landscape Area, U = Unknown - no documented occurrence records from Landscape Area.

3.2.4.1 Northern Sea Otter

The northern sea otter occurs in coastal waters off of northern Japan and the east coast of Russia, north to the Pribilofs and south through the Aleutians, southern Alaska, British Columbia, and Washington State (Nowak 2003). The subspecies of northern sea otter that occurs in the Kodiak area, *Enhydra lutris kenyoni*, is distributed from the Near Islands east and south to British Columbia and Washington. *E. l. kenyoni* is separated from the other subspecies of northern sea otter, *E. l. lutris,* by an open water expanse of approximately 200 miles between the Near Islands of the U.S. and the Commander Islands of Russia. It is separated from the southern sea otter, *E. l. nereis,* on the California coast by approximately 600 miles. Because the potential for genetic exchange among these three groups is extremely low, *E. l. kenyoni* has been identified as the southwest Alaska distinct population segment (DPS) of the northern sea otter. This DPS was listed as threatened under the ESA in 2005 (50 CFR Part 17).

On December 16, 2008, the USFWS issued a proposed rule to designate critical habitat for the Southwest Alaska DPS of the northern sea otter (Federal Register Vol. 73, No. 242 pp. 76454-76469). Areas proposed for critical habitat include waters within either the 65.6-ft depth contour or the 328.1-ft nearshore zone, or both (where these two areas overlap). These waters cover a total of approximately

5,879 square miles in southwestern Alaska, including a substantial portion of Chiniak Bay. Under this rule, all of St. Paul Harbor, Womens Bay, and Middle Bay as well as the Kalsin Island-Queer Island-Broad Point area would be designated as critical habitat. The proposed rule excludes from critical habitat all developed areas, such as piers, docks, harbors, marinas, jetties, breakwaters, and other areas that lack primary constituent elements (PCEs). PCEs for the Southwest DPS of the northern sea otter include: (1) shallow rocky areas less than 6.6-ft deep where marine predators are less likely to forage, (2) nearshore waters within 328.1 feet of the mean high tide line, (3) kelp forests in water depths less than 65.6-ft that provide protection from marine predators, and (4) prey resources within the areas identified by PCEs 1-3 that are present in sufficient quantity and quality to meet the energetic requirements of the species. Although nearshore waters in the vicinity of the Airport appear to contain these PCEs, portions of the Airport shoreline have been created from fill and armor rock, and it is therefore unclear how much of the Study Area would be considered critical habitat under the proposed rule. The EIS Team will coordinate with USFWS personnel to determine how the proposed rule applies to nearshore waters within the Study Area.

Sea otters generally occur in shallow water areas near the shoreline. They forage primarily in shallow water areas less than 100 m (328 feet) deep, and the majority of all foraging dives take place in waters less than 30 m (98 feet) deep (Bodkin et al. 2004). As water depth is generally correlated with distance to shore, sea otters typically inhabit waters within 1 to 2 km (0.62–1.24 miles) of shore (Riedman and Estes 1990 as cited in Angliss and Outlaw 2007). Although sea otters can also be found at greater distances from shore, this typically occurs in areas of, or near, shallow water.

Northern sea otters are primarily associated with rocky marine habitats, and although they may occur further seaward, they tend to congregate between the shoreline and the outer limit of the kelp canopy where present (Riedman and Estes 1990 as cited in Angliss and Outlaw 2007). Sea otters also inhabit marine environments with soft sediment substrates more typical of the Archipelago. In rocky substrate habitats, primary prey includes sea urchins, octopus, and mussels. In soft-substrate habitats, clams tend to be otters' principal prey. Sea otters are considered a keystone species because they have a strong influence on the species composition and diversity of the nearshore marine environment in which they occur (Estes et al. 1978). For example, studies of subtidal communities in Alaska have demonstrated that when sea otters are abundant, herbivores such as sea urchins are kept at low densities due to otter predation, and kelp, which are consumed by sea urchins, tend to flourish. Areas containing kelp have complex habitat structure that promotes biological diversity. Conversely, when otters are absent, grazing by abundant sea urchin populations creates areas of low kelp abundance (Estes and Harrold 1988), which simplifies habitat structure and reduces diversity.

Sea otters are quite common in Chiniak Bay year-round, and one or two individuals were regularly observed off the shore of the Airport during shore-based bird and marine mammal surveys. Table 8 summarizes the sea otter observations made during the Airport point-count surveys. Otters were observed in various portions of the Study Area in all four seasons and off of each of the runway ends. The majority of observations were in the higher distance categories. However, off Runway End 36, otters were seen in all distance categories during the winter.

Table 8. Northern Sea Otter Observations during Airport Point-count Surveys

Runway End	Season	Distance from Runway End	Count
18	Winter	>1,200 feet	1
25	Fall	800 feet–1,200 feet	1
	Winter	>1,200 feet	2
	Spring	>1,200 feet	1
29	Fall	800 feet–1,200 feet	2
	Winter	>1,200 feet	3
	Summer	>1,200 feet	4
36	Fall	800 feet–1,200 feet	1
		>1,200 feet	1
	Winter	< 400 feet	2
		400 feet–800 feet	2
		800 feet–1,200 feet	1
		> 1,200 feet	5
	Spring	< 400 feet	1

Source: SWCA Airport point-count surveys 2007–2008

As described in Section 3.1 Methods, three boat-based sea otter surveys of Chiniak Bay were conducted as part of the Airport EIS field survey effort. A total of 291 otters were observed during the boat-based survey effort. The largest groups observed at a given time comprised 14 to 25 individuals. These groups were located in the Cliff Island-Cliff Point to Discover Rocks area, approximately 1 to 2 miles southeast and east of the Airport, in the Kalsin Island-Queer Island-Broad Point area, and in the Middle Bay area, both approximately 6 miles southeast and south of the Airport, respectively. Smaller groups of otters were found throughout the survey area. Results of the boat-based surveys are depicted on Figure 5.

From data obtained during the boat-based surveys, sea otter densities were calculated for each survey stratum. The average densities of sea otters by stratum are presented in Table 9. The methodology used to calculate sea otter densities is available in Section 3.2.3.4 Steller's Eider.

Table 9. Northern Sea Otter Densities within the Landscape Area

Survey Stratum	Survey Month		
	February (otters/km²)	May (otters/km²)	September (otters/km²)
Study Area Nearshore	6.49 (std err = 3.66)	0.39 (std err = 0.39)	5.46 (std err = 2.19)
Landscape Area Nearshore	4.46 (std err = 2.06)	6.08 (std err = 4.89)	4.30 (std err = 1.88)
Study Area Pelagic	1.90 (std err = 1.08)	3.37 (std err = 2.29)	1.90 (std err = 1.03)
Landscape Area Pelagic	3.71 (std err = 2.68)	1.30 (std err = 0.42)	5.78 (std err = 3.09)

Source: SWCA boat-based surveys of Chiniak Bay

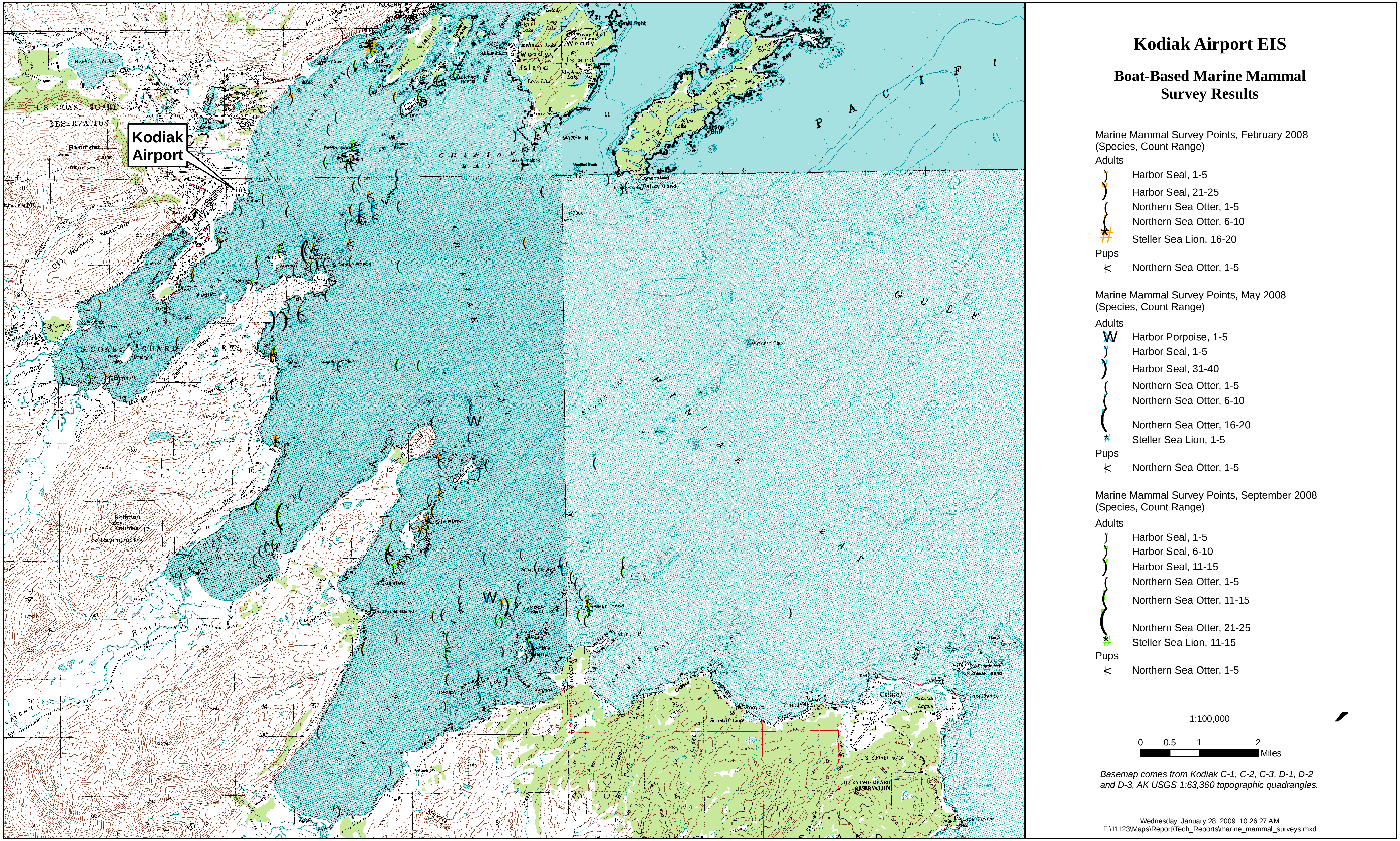

Figure 5. Results of the boat-based surveys.

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It was found that there is no statistically significant difference in estimated sea otter densities between months in a given stratum or between strata in a given month. As evidenced by the standard error values in Table 9, the lack of statistically significant differences in otter density by stratum is likely a result of the high levels of variance observed in otter density between transects. The February and September Landscape Area Pelagic and May Study Area Pelagic otter densities are relatively high for this stratum because of the proximity of some of the offshore transects to islands, islets, and rocks. Weather conditions prevented completing several survey transects in the eastern half of Chiniak Bay, so the Landscape Area Pelagic transects that were surveyed were mostly in the western half of the bay.

3.2.4.2 Steller Sea Lion

The Steller sea lion occurs across the North Pacific from northern Japan, through the Kuril Islands and Okhotsk Sea of Russia, to the Aleutian Islands, central Bering Sea, southern coast of Alaska, and southward through the Pacific Northwest coast to the Channel Islands off the coast of California. The world population is separated into two stocks divided at 144°W Longitude or Cape Suckling, Alaska, based on differences in mitochondrial DNA and differing population trends in the two regions (Angliss and Outlaw 2007). Kodiak Island falls within the range of the Western stock, which has experienced substantial population declines and is listed as endangered under the ESA. Based on 2004–2005 data, the population size of western Steller sea lions in Alaska is estimated to be approximately 45,000 animals (National Marine Fisheries Service 2008). This population showed an increase of approximately 3% per year between 2000 and 2004, the first recorded increase since the 1970s. The most recent data from incomplete 2006–2007 non-pup surveys suggest that the overall population trend for the western DPS is either stable or slightly declining (National Marine Fisheries Service 2008).

Steller sea lions are opportunistic predators and feed on a variety of fishes and cephalopods. Prey species tend to vary seasonally and geographically. Preferred prey species in the Gulf of Alaska include walleye pollock, Pacific herring, capelin, Pacific sand lance, Pacific cod, salmon, and cephalopods such as squid and octopus (National Marine Fisheries Service 2008). Small forage fishes and salmon make up the majority of Kodiak sea lion diet in the summer, whereas other fishes and cephalopods are eaten more frequently in the summer and fall. Steller sea lions have also been known to prey on other pinnipeds such as the harbor seal, fur seal, ringed seal, and possibly sea lion pups, but these prey are considered to be a minor, supplemental component to their diet.

Steller sea lions gather on well-defined, traditionally used haulouts and rookeries to rest and breed, respectively. The nearest rookery, which is also designated critical habitat under the ESA, is located on Marmot Island, approximately 38 miles northeast of the Airport. Although there are no rookeries within inner Chiniak Bay, there are known sea lion haulouts in the area. Two major haulouts occur on the edge of the Landscape Area, i.e., on the outer edge of Chiniak Bay. One of these is located on Long Island (approximately 11 miles east-northeast of the Airport) and one on Cape Chiniak (approximately 15 miles southwest of the Airport) (NOAA 1997). Both of these haulouts are designated critical habitat under the ESA (50 CFR Part 226). One nontraditional, human-made haulout is located in Dog Bay in the Kodiak boat harbor on Near Island. The Dog Bay haulout was created out of empty dock to discourage Steller sea lions from hauling out on active harbor floats and to limit human-sea lion interactions. Dog Bay has a small number of year-round inhabitants consisting of individual sea lions that frequent the harbor and nearby cannery docks.

No Steller sea lions were observed during the Airport point-count surveys. A total of 40 Steller sea lions were observed during the boat-based surveys, consisting of 19 in February, seven in May, and 14 in September, 2008. All but two of these individuals were observed out of the water, resting on the Dog Bay haulout in Kodiak's Inner Harbor (Figure 5).

3.2.4.3 Harbor Seal

Harbor seals occur in coastal and estuarine waters from Baja California, north along the west coast of the U.S. and Canada, west through the Gulf of Alaska and the Aleutian Islands, and into the Bering Sea north to Cape Newenham and the Pribilof Islands. Although young harbor seals have been known to disperse up to 190 miles, the harbor seal is non-migratory and makes only limited movements for foraging and breeding (Nowak 2003). Harbor seals live primarily along shorelines and estuaries and commonly rest on sandbanks, easily accessible beaches, reefs, and protected tidal rocks (Nowak 2003). Newly weaned young feed primarily on shrimp and other small, benthic crustaceans. Older animals subsist on octopus and on a variety of fish, including herring, trout, cod, flounder, and salmon. (Nowak 2003).

Though harbor seals are typically solitary, several hundred may aggregate ashore during the breeding season (June–July), and individuals may also come together at favored haul outs. The current statewide harbor seal population estimate is approximately 180,000, based on surveys conducted between 1996 and 2000 (Angliss and Outlaw 2007). The harbor seals of Kodiak are part of the Gulf of Alaska stock as defined by the National Marine Fisheries Service (NMFS). The most recent Stock Assessment Report (SAR) for harbor seals estimates that the Gulf of Alaska stock comprises approximately 46,000 individuals. From the mid-1970s to the 1990s there was a steady decrease in numbers of harbor seals reported in the Archipelago. Over the period of 1993–2001, there was an increase in harbor seal numbers of 6.6% per year (Angliss and Outlaw 2007). Despite these indications of population growth in certain areas, the overall Gulf of Alaska stock size remains relatively small compared to its size in the 1970s and 1980s (Angliss and Outlaw 2007).

According to National Oceanic and Atmospheric Administration data, there are six harbor seal haulouts in Chiniak Bay, which were occupied by 288 individuals in August of 2006 (Peter Boveng, Biologist at National Marine Mammal Laboratory, personal communication with Cathy Foy, SWCA, July 12, 2007). The closest haul out to the Airport is located on a group of rocks in Chiniak Bay, approximately 2 miles due east of the Airport shoreline. Recent tagging studies indicate that harbor seals use the Chiniak Bay Study Area throughout the year. Harbor seals were observed year-round in nearshore waters adjacent to runway ends during the Airport point counts. During the boat-based surveys, nearly 200 harbor seals were observed. The majority of these observations were made in May, and most of the individuals observed were hauled out on rocks on the south side of Cliff Point and in the Middle-Svitlak-Kekur Island area near the mouth of Kalsin Bay (Figure 5). Harbor seals are occasionally taken for subsistence purposes.

3.2.4.4 Harbor Porpoise

In the eastern North Pacific Ocean, the harbor porpoise frequents coastal waters, bays, estuaries, and the mouths of large rivers from Point Conception, California, north to Point Barrow, Alaska (Nowak 2003, Angliss and Outlaw 2007). In the Gulf of Alaska, they occur most frequently in waters less than 100 m deep (Hobbs and Waite cited in(Angliss and Outlaw 2007). Their diet consists of smooth, nonspiny fish, approximately 10 to 25 cm long, such as herring, pollock, and cod (Gaskin et al. 1974 cited in (Nowak 2003). Genetic testing and pollutant load investigations along the west coast of North America suggest that harbor porpoises from California to British Columbia are non-migratory. Whether this is true of the Alaska population is currently unknown due to insufficient sample sizes.

Harbor porpoises in the Kodiak area belong to the Gulf of Alaska stock. Based on aerial surveys conducted in June and July 1998, the size of the Gulf of Alaska stock is estimated at approximately 42,000 individuals. At present, there is no reliable information to determine a population trend for harbor porpoises (Angliss and Outlaw 2007). Although there are no specific studies of harbor porpoise in

Chiniak Bay, Angliss and Outlaw (2007) cite two mortalities due to entanglement in the Kodiak Island set gillnet fishery. The boat surveys of Chiniak Bay detected a total of six harbor porpoises, four in February and two in May 2008. One of these observations was in the middle of Chiniak Bay and the other five were east of Broad Point in the Kalsin Bay area (Figure 5).

3.2.4.5 Dall’s Porpoise

Dall's porpoise are widely distributed in the North Pacific, occurring from Baja California north to the Gulf of Alaska and Bering Sea and south to Japan (Nowak 2003, Angliss and Outlaw 2007). The only apparent gaps in their distribution in Alaskan waters are upper Cook Inlet and the shallow eastern flats of the Bering Sea (Angliss and Outlaw 2007). Although Dall’s porpoise sometimes occur near land, they are generally found well offshore in seas more than 180 m deep (Nowak 2003). Throughout most of the eastern North Pacific, Dall's porpoise are present year-round, though there is a tendency for Dall's porpoise to concentrate near the shore and to the south during the autumn and winter and off-shore and to the north in the spring and summer. These seasonal movements are likely related to distributional changes in prey organisms (Nowak 2003). Dall's porpoise commonly prey on squid and small, unarmed fish such as herring living at depths in excess of 180 m (Nowak 2003). Dall’s porpoise is well known to fishermen in the Kodiak region; however, use of Chiniak Bay by Dall’s porpoise is not documented. There were no observations of Dall's porpoise during the EIS field surveys.

3.2.4.6 Killer Whale

The killer whale, or orca, is the largest member of the dolphin family and occurs in all the oceans and adjoining seas of the world (Nowak 2003, Angliss and Outlaw 2007). Although documented in tropical and offshore waters, killer whales occur in higher densities in colder, more productive waters of both hemispheres, with the highest concentrations found at high attitudes (Angliss and Outlaw 2007). The killer whale often enters shallow bays, estuaries, and the mouths of rivers (Nowak 2003). Killer whales take a wide variety of prey, including fish, octopus and squid, seals and sea lions, and other cetaceans (dolphins, porpoises, and whales) (Nowak 2003).

Seasonal and year-round occurrence has been reported for killer whales in Alaska and in the intercostals waterways of British Columbia and Washington State, where pods have been labeled as "resident," "transient," and "offshore" based on morphological, ecological, genetic, acoustic, and behavioral attributes (Angliss and Outlaw 2007). Several studies have provided evidence that these three ecotypes are genetically distinct, and genetic distinctions have also been found between populations within the transient and resident ecotypes. Killer whales in the Kodiak area fall into these two ecotypes.

3.2.4.6.1 Alaska Residents

Alaska Resident killer whales are primarily fish eaters and are found from southeastern Alaska to the Aleutian Islands and to the Bering Sea. Intermixing of Alaska Residents has been documented among these three areas (Angliss and Outlaw 2007). The 2001/2004 estimated size of the Alaska Resident stock is 1,123 animals, approximately 500 of which occur in western Alaska pods, which include the Kodiak area. Although there are data to indicate that the portion of the Alaska Resident stock that summers in the Prince William Sound and Kenai Fjords area is increasing, there is currently insufficient data to determine trends in population abundance for the stock as a whole (Angliss and Outlaw 2007). Alaska Residents occur in Chiniak Bay on an ephemeral, transient, and unpredictable basis (Kate Wynne, Marine Mammal Specialist-University of Alaska, personal communication with Catherine Foy, SWCA, February 10, 2008).

3.2.4.6.2 Transients

Killer whales in the Gulf of Alaska Transient stock are primarily marine mammal eaters and are found throughout the Gulf of Alaska, Aleutian Islands, and Bering Sea. Current population estimates put the number of Alaska transients at 314 whales. Of this total, 93 transient whales were identified in the Gulf of Alaska and the remainder in the Aleutian Islands and Bering Sea. At present, reliable data on population trends of the Gulf of Alaska, Aleutian Islands, and Bering Sea stock of killer whales are unavailable (Angliss and Outlaw 2007). Two pods of transients, locally known as the "Kodiak Killers" occur in Chiniak Bay on a fairly predictable basis, with numbers peaking between late February and early April (Kate Wynne, Marine Mammal Specialist-University of Alaska, personal communication with Catherine Foy, SWCA, February 10, 2008). These pods come into Kodiak Harbor to prey on sea lions that are using the Dog Bay haul out. Outside of the harbor, their use of and frequency of occurrence in Chiniak Bay is unknown. There were no killer whales observed during the EIS field surveys.

3.2.4.7 Cuvier’s Beaked Whale

Cuvier's beaked whale, also known as the goose-beaked whale, occurs in temperate and tropical waters of all oceans and adjoining seas except for high polar waters (Rice 1977 cited in: (Nowak 2003). They are primarily tropical in distribution but move into temperate northern waters during the summer and have been documented in the Gulf of Alaska and Aleutian Islands (Harrison 1979 and Rice 1978 cited in: (Nowak 2003). Their distribution is known primarily from strandings (Angliss and Outlaw 2007). Cuvier's beaked whales typically occur in groups of up to 40 individuals and are usually found well offshore. They are known to dive to great depths and their diet consists mainly of squid and deep-water fish (Nowak 2003). Sightings of Cuvier's beaked whale are rare, perhaps because it has a low and diffuse blow and there is some evidence that they avoid vessels by diving (Heyning 1989 cited in: (Angliss and Outlaw 2007)). Due to the paucity of data on Cuvier's beaked whale, there are currently no estimates of population size or trend for the Alaska stock of this species.

Though there is no documentation of Cuvier's beaked whale in Chiniak Bay; however, two strandings have occurred on northeast Kodiak in the general vicinity of Chiniak Bay (Angliss and Outlaw 2007). There were no observations of Cuvier's beaked whale during the EIS field surveys.

3.2.4.8 Gray Whale

Gray whales occur in relatively shallow coastal waters from the Sea of Okhotsk to southern Korea and Japan, and from the Chukchi and Beaufort Seas to the Gulf of California (Rice 1977 cited in: (Nowak 2003)). Gray whales that occur in the Kodiak area belong to the eastern North Pacific stock. The majority of the eastern North Pacific stock spends the summer feeding in the northern Bering and Chukchi seas (Angliss and Outlaw 2007). A portion of this stock, however, is known to feed in the summer in waters off southeast Alaska, off British Columbia, and off of the coasts of Washington, Oregon, and California. In the fall, gray whales migrate south along the coast to Baja California, Mexico, where they spend the winter in certain shallow lagoons and bays. Calves are born from early January to mid-February, after which the northbound migration commences and continues through June.

Gray whales are baleen whales, and their feeding takes place primarily on the bottom where they apparently plow their heads sideways through bottom sediments to stir up prey (Ellis 1980 cited in: Nowak 2003). Water and organisms are sucked into the mouth, and then the water is expelled through the baleen, trapping food inside the mouth. The gray whale diet consists primarily of small crustaceans, especially *Ampelisca macrocephala*, which are approximately 1 inch long and found on sandy bottoms at depths of 5 to 300 m (Rice and Wolman 1971 cited in: Nowak 2003). Other crustaceans, some mollusks and worms, and small fish are also eaten (Nowak 2003). Available information suggests that gray whales only feed in the northern part of their annual migration and may fast up to six months at a time (Rice 1978 cited in Nowak 2003).

A population estimate from 2001/2002 indicated that there were approximately 18,180 individuals in the eastern North Pacific stock. Although this is a substantial reduction from the population size of approximately 29,760 animals estimated in 1997/1998, the population has been steadily increasing over the last several decades.

Gray whales migrate twice a year past eastern Kodiak Island on their annual migration to and from their feeding grounds in the Bering and Chukchi seas. The southern migration of whales is expected in mid-December and possibly continues until the first week of January (Rugh et al. 2001). Migration northward past Kodiak occurs from mid-April through the first week in May. Although most gray whales are migratory, (Moore et al. 2007) grays remaining in eastern Kodiak waters year-round were documented in surveys conducted from 1999 to 2003. During this study, gray whales were not seen in the Chiniak Bay waters (though a small group was observed on the eastern edge of Chiniak Bay just northeast of Chiniak Point during the spring). They were found in large concentrations near the mouth of in Ugak Bay, the next bay south of Chiniak, in all four seasons. Mud plumes observed around the whales indicated that they were feeding. There were no gray whales observed during the EIS field surveys.

3.2.4.9 Fin Whale

Within Pacific U.S. waters, fin whales are found seasonally off the coasts of North America and Hawaii and in the Bering Sea in the summer (Angliss and Outlaw 2007). NMFS recognizes three stocks of fin whales, including the Alaska (Northeastern Pacific) stock, the California/Washington/Oregon stock, and the Hawaii stock. The Alaska stock consists of fin whales that occur along the central Alaskan coast, including the Archipelago. Most populations of fin whale are considered to be highly migratory, occupying cold temperate and polar waters in the spring and summer and warm temperate and tropical waters in the autumn and winter (Nowak 2003).

The fin whale is a pelagic species and is seldom found in water less than 200 m deep. Fin whales are baleen whales and feed primarily on zooplankton such as of shrimp-like creatures in the Euphausiidae family, other crustaceans, and various kinds of small fish (various authors cited in Nowak 2003). The fin whale uses a swallowing method of feeding in which the animal turns on its side with its head above water and its mouth open. After taking in a great amount of food organisms and water, water is forced out of the mouth with the tongue, leaving food trapped in the baleen.

During surveys conducted in July and August of 2001–2003, fin whales were sighted in waters east of Kodiak to Samalga Pass, and the population was estimated at approximately 1,650 whales in this area (Zerbini et al. [in press] cited in Angliss and Outlaw 2007). Fin whales are rarely seen in Chiniak Bay, with only rare occurrences in the deep water at the mouth of the bay (Baraff 2006). Whale surveys in Chiniak Bay for (Witteveen et al. 2006) and for Baraff (2006) occurred during the summer and fall. There is no known documented use of Chiniak Bay by fin whales in the winter and spring. Nevertheless, fin whales have been observed by Wynne and Witteveen during winter tagging work in Uganik Bay on the northwest side of Kodiak Island (Briana Witteveen, Marine Mammal Research Technician-University of Alaska, personal communication with Catherine Foy, SWCA, November 10, 2007). There were no fin whales observed during the EIS field surveys of Chiniak Bay.

3.2.4.10 Humpback Whale

The humpback whale is distributed seasonally throughout the world's oceans but does not occur in arctic waters of the North Pacific. The historic feeding range of the North Pacific population includes coastal and inland waters around the Pacific Rim from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and southwest to the Kamchatka peninsula and the Sea of Okhotsk (various authors cited in Angliss and Outlaw 2007). Kodiak lies in a zone of overlap between the Western and Central North Pacific stocks of humpback whales. The Western North Pacific stock primarily winters off Japan and summers primarily west of Unimak Pass, though they may extend as far east as Kodiak Island. The Central North Pacific Stock of humpback whales spends winter and spring in the Hawaiian Islands and migrates to northern British Columbia, Southeast Alaska, and Prince William Sound west to Kodiak in the summer and fall (Angliss and Outlaw 2007). The Central North Pacific Stock is further divided into three separate feeding aggregations: southeastern Alaska, Prince William Sound, and Kodiak. Humpback whales are baleen whales and feed primarily on euphausiids and small, schooling fish such as Pacific herring, eulachon, Pacific sand lance, capelin, walleye pollock, and haddock.

The minimum population size estimated for Central North Pacific stock is approximately 3,700 whales (Angliss and Outlaw 2007). Earlier data indicated that the Central North Pacific stock increased in abundance between the early 1980s and early 1990s. Population trend estimates for the Central North Pacific stock indicate that this group is increasing at a rate of 6.6% to 7% per year (Mobley et al. 2001, Zerbini et al [in press], cited in: Angliss and Outlaw 2007).

Humpback whales range widely throughout Chiniak Bay and are known to occur in this bay in the summer and fall, with peak abundances occurring in June and July (Baraff 2006, Witteveen et al. 2006). Humpback use of Chiniak Bay is expected to be low in the winter and spring because most animals migrate southward to warmer waters during the winter. Nevertheless, humpback whales have been observed by Wynne and Witteveen in Uganik Bay (on the northwest side of Kodiak Island) during the winter, so it is possible that humpbacks could occur in Chiniak Bay on a year-round basis. No humpback whales were observed during the EIS field survey effort.

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Appendix A. Plants Observed at the Airport, Including their Scientific Names and Associated Land Cover Types

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Table A-1. Plants observed[1] at the Airport, Including their Scientific Names and Associated Land Cover Types

Common Name	Scientific Name	Land Cover Type(s)[2]
common yarrow	*Achillea millefolium*	EFM, AWM
spike bentgrass	*Agrostis exarata*	EFM, AWM
rough bentgrass	*Agrostis scabra*	EFM, AWM, ASE
bentgrass	*Agrostis* sp.	EFM
Sitka alder	*Alnus sinuata*	AWM
seacoast angelica	*Angelica lucida*	EFM, AWM, ASE
goatsbeard	*Aruncus sylvester*	EFM
lady fern	*Athyrium filix-femina*	SSF
moonwort	*Botrychium* spp.	EFM
Sitka brome	*Bromus sitchensis*	ASE, EFM
American searocket	*Cakile edentula*	RS
bluejoint reedgrass	*Calamagrostis canadensis*	EFM, AWM
common harebell	*Campanula rotundifolia*	EFM
sedge	*Carex* spp.	AWM
enchanter's nightshade	*Circaea alpina*	SSF
Canada thistle	*Cirsium arvense*	EFM
bunchberry	*Cornus canadensis*	EFM, AWM
spiny woodfern	*Dryopteris expansa*	SSF
American dunegrass	*Elymus mollis*	EFM
crowberry	*Empetrum nigrum*	EFM
fireweed	*Epilobium angustifolium*	AWM, ASE
common horsetail	*Equisetum arvense*	AWM
Chamisso's cotton-grass	*Eriophorum chamissonis*	EFM
fescue	*Festuca* spp.	EFM
hemp-nettle	*Galeopsis tetrahit*	ASE
large-leaved avens	*Geum macrophyllum*	EFM, AWM
oak fern	*Gymnocarpium dryopteris*	SSF
cow parsnip	*Heracleum lanatum*	AWM
seabeach sandwort	*Honkenya peploides*	RS
meadow barley	*Hordeum brachyantherum*	EFM, AWM
hairy cat's ear	*Hypochaeris radicata*	EFM
beach pea	*Lathyrus maritimus*	EFM
Nootka lupine	*Lupinus nootkatensis*	ASE
many-flower woodrush	*Luzula multiflora*	EFM, AWM
pineapple weed	*Matricaria discoidea*	EFM
sea bluebells	*Mertensia maritima*	RS

Table A-1. Plants observed[1] at the Airport, Including their Scientific Names and Associated Land Cover Types

Common Name	Scientific Name	Land Cover Type(s)[2]
devil's club	*Oplopanax horridus*	SSF
reed canary grass	*Phalaris arundinacea*	AWM
Sitka spruce	*Picea sitchensis*	SSF
common plantain	*Plantago major*	EFM, AWM
sea plantain	*Plantago maritima*	EFM
annual bluegrass	*Poa annua*	EFM
bluegrass	*Poa* spp.	EFM, AWM
black cottonwood	*Populus trichocarpa*	AWM
slender cinquefoil	*Potentilla gracilis*	EFM
alkaligrass	*Puccinellia* spp.	RS
wintergreen	*Pyrola* spp.	AWM
western buttercup	*Ranunculus occidentalis*	ASE
rattlebox	*Rhinanthus minor*	EFM
Nootka rose	*Rosa nutkana*	AWM
salmonberry	*Rubus spectabilis*	AWM, SSF
sheep sorrel	*Rumex acetosella*	EFM, ASE
curly dock	*Rumex crispus*	EFM
Scouler willow	*Salix scouleriana*	AWM
Sitka willow	*Salix sitchensis*	AWM
red elderberry	*Sambucus racemosa*	SSF
beach groundsel	*Senecio pseudoarnica*	EFM
common groundsel	*Senecio vulgaris*	EFM
sibbaldia	*Sibbaldia procumbens*	EFM
shore blue-eye grass	*Sisyrinchium litorale*	EFM, ASE
Canada goldenrod	*Solidago canadensis*	AWM
dandelion	*Taraxicum* spp.	EFM
pink clover	*Trifolium hybridum*	EFM, ASE
red clover	*Trifolium pratense*	EFM, ASE
white clover	*Trifolium repens*	EFM, ASE
green false hellebore	*Veratrum viride*	AWM

[1]Plants observed during upland vegetation surveys (September 2007). This is not a complete list of plants that occur at the Airport.
[2]EFM=Elymus Forb Meadow; AWM=Alder-Willow MIx; ASE=Alder-Salmonberry-Elderberry; SSF=Sitka Spruce Forest; RS=Rocky Shore

Appendix B. Kodiak Airport EIS Wildlife and Marine Mammal Surveys

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Appendix B. Kodiak Airport EIS Wildlife and Marine Mammal Surveys

These surveys are being undertaken as part of the Kodiak Airport EIS. The protocol was also designed to, in part, replicate the 1999–2000 wildlife surveys conducted by USDA Wildlife Services in preparing a wildlife hazard assessment for the airport.

Survey Objective

Quantify wildlife relative abundance and seasonal trends throughout the airfield and within and adjacent to the proposed runway safety area improvement footprint.

Survey Protocol

These standardized surveys are based in part on the Airport Wildlife Hazard Assessment (USDA 2000) and the USFWS Breeding Bird Survey (BBS) protocol. Although designed to document bird activity, upland and marine mammals will also be recorded when observed. Data on wildlife species and their numbers will be collected from established observation points along a survey route. A survey is defined as one visit to all observation points. Binoculars and/or a spotting scope can and should be used by the observer when appropriate.

Thirteen observation points are located around the airfield (Figure 1). Eleven of these points are the same points (or slightly moved points) as those used in the wildlife hazard study. Two points have been added to areas in and around airport property that may be affected by the proposed action or its alternatives.

At points 1–4, 6, 10–13 (the inland points) all wildlife (bird or mammal) activity within 600-foot (183 m) radius will be recorded for 10 minutes. These 10 minute counts will be broken down into 0–3, 3–5, and 5–10 minute intervals. The observer's best professional judgment should be used to determine when to start the point given the ambient noise in the area (airplane taxi, takeoff, and landing). Explicit identification of plane activity should be mentioned in the comments field. No acclimation period is necessary to begin the point count. During the breeding season morning surveys should be conducted during peak bird activity. During nonbreeding times of the year surveys may be done anytime during daylight hours.

For the inland points surveys should generally not be conducted during heavy precipitation, dense fog, and high wind speeds, because detectability of birds is significantly affected by these conditions. Heavy precipitation and fog are relatively self-explanatory—a light drizzle is acceptable for surveying, but persistent, heavy rain is not.

During surveys wind speeds generally should not exceed 25 to 30 mph, which is when larger branches and small deciduous trees begin to sway in the wind. However, use your best judgment for the habitat you work in. In forested habitats, wind speeds >25 mph are a problem, because ambient noise and motion of vegetation greatly reduce the detectability of birds. In open habitats, you can usually continue to survey in higher winds than in forested habitats. Either way, always record the weather conditions at the time of the survey.

The following environmental data will be collected at each site:

Site number: Observation Point Number (1–13)

Surveyor: Three Initial Code (First Name, Middle Name, Last Name)

Date: Month/Day/Year

Helper (if any): Three Initial Code

Start Time: Time at which the survey was begun (military time)

% Cloud Cover: The percent of the total sky covered in clouds at the beginning of the survey

Wind Speed/ Direction: The wind speed in miles per hour, and the direction the wind is coming from

Precipitation: Rain, sleet, hail or snow

Temperature: Circle which range the air temperature is in

At the marine points (points 5, 7, 8, 9) all wildlife activity within 2,500 feet (762 m), or as far as conditions will allow, will be recorded for 30 minutes. These thirty minute counts will be broken down into 0–3, 3–5, 5–10, and 10–30 minute intervals. The judgment of the observer and a daily schedule of airport activity should be used to determine when to start the point given the ambient noise and visibility in the area. The marine points should be prioritized as follows in order to plan around takeoff/landing (busiest to least busy): 8, 9, 5, 7. No acclimation period is necessary to begin the point count. A diversity of tidal stages should be sampled in each of the four seasons.

Before beginning the survey, permanent reference points that will act as dividing lines for the field of view for each observation points should be determined. For example, to establish separate fields of view for points 8 and 9, draw a straight line from a point on the shore equidistant between points 8 and 9 to a group of rocks, a buoy, piling or other easily seen reference point to act as a dividing line between the two points. When conducting the survey, anything to the left of this line should be included in the Point 9 survey, and anything to the right of those rocks would be included in the survey for Point 8. A compass bearing from the shore to the reference marker should be given to SWCA shortly after the first survey has been completed.

If the observer is forced to abandon the marine point due to approaching aircraft, he/she should take the following steps. First, halt the survey and note the time, mark the time on the data sheet and note how many minutes are left to complete the survey. Then move from the marine point to the Safety Zone point previously appointed. For marine points 9 and 8 the observer should move to safety zone point 1, for marine point 7 the observer should move to safety point 2, and for marine point 5 the observer should move to safety point 3. Once the observer has safely made it to the safety zone he/she should continue making observations though only as incidental sightings, making sure to note anything that he/she thinks may be important. Once the observer has been cleared to return to the marine point, he/she should halt the incidental sightings and return to the point-count station. Once at the marine point the observer should note the time and the new ending time to complete the 30-minute survey. The observer should continue the survey as if it were not interrupted, making sure to note any major changes that took place during the interruption.

The marine points should generally not be conducted under conditions that severely limit the visual detectability of the birds. Precipitation of any kind should not be a deterrent to conducting the surveys unless it affects visual acuity. The professional judgment of the observer will be key in making the decision whether or not the surveys can be conducted.

In addition to the entries described above, the following environmental data will be taken at marine points:

Sea Surface Condition: A description of a combination of wave height and wind, resulting in Calm, Light Chop, Moderate Chop, or Heavy Chop surface conditions. Feel free to use other descriptors if they seem to fit better.

Glare: A determination of the amount of reflection off the ocean surface. High, Medium, Low

Tide Condition: The tide level at the time of the survey, measured in feet.

In Car/Out of Car: Circle where the majority of the survey was taken.

Scope/ No Scope: Circle whether a scope was used for the survey.

Other Comments: Describe other ocean surface conditions and how that might affect survey quality.

The Table below displays the data entry fields for both marine and upland points with sample entries. Explanation for each data field is found below.

Table B.1. Sample Avian Point-count Data Table

Time (0–3, 3–5, 5–10)	Species Code	Species Full Name	Number of Individuals	Distance (feet)	Flyover/ Auditory/ Visual	Direction (degrees)*	Behavior
0–3	CORA	Common Raven	3	150	A/V	153	Perched in tree
0–3	HADU	Harlequin Duck	8	75	V	200	Diving. Seem to be foraging in area.
3–5	HEGU	Herring Gull	2	NA	F	NA	Flying from W to E overhead.

Time: The period of time within your 10 minute survey period that the individual was seen/heard. 0–3, 3–5, 5–10, 10–30.

Species Code/Species Full Name: Use four-letter species codes updated in 2007 by Pyle and DeSante. These codes can be found at http://www.birdpop.org/AlphaCodes.htm. In the field, either the species code or full name can be used. However, when turning the data sheet into SWCA for analysis, please make sure both fields are filled in.

 # Ind: The number of individual birds of this species the same distance and direction from the observer. Many times this entry will be “1”, but when entering a flock of birds, it will be higher.

Distance (feet): The distance the bird is from the observer in feet. Given the importance of distance measurements in avian monitoring, range finders will be used to improve the accuracy of distance measurements between the observer and the bird being observed (Buckland et al. 1993).

Flyover/Auditory/Visual: The way the bird was detected. The flyover pertains specifically to birds that fly past the Study Area without stopping and without making any use of the habitat within the Study Area. If a bird flying by the Study Area uses the habitat in any manner, then the action is not a flyover. If a bird is flying past the Study Area but ends up circling the area and landing, this is not a flyover.

Direction (degrees): The compass direction the bird is from the observer. This entry is only needed for marine points. When taking compass bearings, be sure to stand at least 30 feet away from electronics and metal (GPS, car) unless your compass is properly shielded from these influcences.

Behavior: The behavior of the animal. This field is most important for marine points. Some possible entries are “circling,” “foraging,” “diving intermittently,” “running along the shore,” “perching,” or anything that might give a better idea of animal activity. This field should also include whether breeding activities were seen (during breeding season). Breeding activities include observing the bird on a nest, carrying nesting material, copulating, carrying nesting material, and fledging.

Incidental Sighting: List birds seen and/or heard between points. No distance or direction data need to be taken for these birds, but note whether breeding activities listed above were observed.

Mammals

When a upland mammal is observed, simply write the species (if known) on a line in the data sheet, and a short description of the habitat it was using (airfield, conifer forest, alder shrub, etc.) If a mammal burrow is located, either take distance/direction from an observation point, or take a GPS point at the burrow.

When a marine mammal is observed, write the time of the appearance and species on a line on the data sheet. Also take brief notes about the behavior of the animal.

Table B.2. Sample Mammal Data Table

Time	Species Code	Species Full Name	Number of Individuals	Distance (feet)	Flyover/	Direction (degrees)*	Behavior
(0–3, 3–5,					Auditory/		
5–10)					Visual		
0–3		Harbor Seal	3	83–120	V	153–176	Periscoping
0–3		Humpback Whale	1	1,500	V	200	Swimming parallel to the coast line NE to SW
10–30		Brown Bear	1	2,000	V	98	Fishing in Buskin River

Bird, Wildlife and Marine Mammal Survey Schedule

Table B.3. shows the number of surveys per month that should be completed for both the inland and marine points. The inland points should be viewed as completely independent of the marine points and no correlation in time or date of the surveys is necessary. Surveys may be done at any time of the month but a five day buffer between surveys should always be allowed. For example, if a survey is being done at the marine points Monday January 5th, the next survey should not be done until, at the earliest, Saturday January 10th.

Table B.3. Kodiak Airport Bird, Wildlife and Marine Mammal Survey Schedule, Number of Surveys per Month

Month	Upland Points 1–4, 6, 10–13	Marine Points 5, 7, 8, 9
January	1	3
February	1	3
March	1	2
April	3	1
May	3	1
June	3	1
July	3	1
August	1	1
September	1	1
October	1	1
November	1	2
December	1	3

POINT COUNT FORM

Site #:_____ **Surveyor:**____________ **Date:**____ - ____ - _____ Page___of____

Helper:________________ **Start Time**: ______________

% Cloud Cover: _____ **Wind Speed/Direction**: _____________ **Precipitation**:_______

Temp (oF): <10 10–30 30–50 50–70 70–90 >90

Marine Points Only

Wave Height (Feet)	**0 1–3 3–5 5–7 7+**	**Sea Surface Condition**	
Glare		**Tide Condition***	
	In Car Out of Car	**Scope No Scope**	
Other Comments			

*** Post hoc from on-line table**

Time (0–3, 3–5, 5–10, 10–30*)	**Species Code**	**Species Full Name**	**# Ind**	**Distance (feet)**	**Flyover/ Auditory/ Visual**	**Direction (degrees)***	**Behavior**

Total number of birds observed:_________ * For Marine Points only

Total number of mammals observed:_________

ADDITIONAL COMMENTS

Incidental Sightings (SEen/heard on the way to the point)

Species **Breeding (Y/N)**

KODIAK AIRPORT
POINT COUNT FORM

Time (0–3, 3–5, 5–10, 10–30*)	Species Code	Species Full Name	# Ind	Distance (feet)	Flyover	Direction (degrees)*	Behavior

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Appendix C. Wildlife Species Observed in the Airport Study and Landscape Area

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Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
			Birds			
Greater White-fronted Goose	*Anser albifrons*		SP	R	MW, FW	Observed during migration
Emperor Goose	*Chen cacagica*	A	SP, F, W	C	MW, RS, SGB	
Snow Goose	*Chen caerulescens*		SP, F, W	+	MW, FW	
Black Brant	*Branta b. nigricans*		SP	R	MW, EG	Observed during migration, grazes grassy fields
Canada Goose	*Branta canadensis*		SP, F	R	EFM, EG, FW, MW, RS, SR, SGB	Observed during migration
Tundra Swan	*Cygnus columbianus*		SP	U	FW, MW, SR	Observed during migration
Gadwall	*Anas strepera*		SP, F, W	U	FW, MW, SR, SGB	Present in Archipelago during breeding season
Eurasian Wigeon	*Anas penelope*		SP, F, W	R	FW, MW, SR	
American Wigeon	*Anas americana*		SP, F, W	U (W-R)	FW, MW, SR	Present in Archipelago during breeding season.
Mallard	*Anas platyrhynchos*		SP, S, W, F	C (S-U)	EFM, EG, FW, MW, SR, SGB	Present in Archipelago during breeding season
Northern Shoveler	*Anas clypeata*		SP	U	EFM, EG, FW, MW, SR, SGB	Present in Archipelago during breeding season
Northern Pintail	*Anas acuta*		SP, F, W	R (SP-U)	EFM, EG, FW, MW, SR, SGB	Present in Archipelago during breeding season
Green-winged Teal	*Anas crecca*		SP, F, W	R	EFM, EG, FW, MW, SR, SGB	Present in Archipelago during breeding season

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
Ring-necked Duck.	*Aythya collaris*		F, W	R	FW, MW, SR	
Tufted Duck	*Aythya fuligula*		W	+	MW	
Greater Scaup	*Aythya marila*		SP, F, W	U	AW, FW, MW, SR	Present in Archipelago during breeding season, nests in dense vegetation near water
Lesser Scaup	*Aythya affinis*		W	R	FW, MW, SR	Present in Archipelago during breeding season
Steller's Eider	*Polysticta stelleri*	A	SP, F, W	C (W-U)	EG, EFM, MW, RS, SGB	Important wintering grounds
King Eider	*Somateria spectabilis*		F, W	R	MW	Important wintering grounds
Common Eider	*Somateria mollissima*		SP, F, W	C	MW, RS	Present in Archipelago during breeding season
Harlequin Duck	*Histrionicus histrionicus*		SP, S, W, F	C (S-U)	MW, RS, SR	Present in Archipelago during breeding season
Surf Scoter	*Melanitta perspicillata*		SP, F, W	U	ASE, FW, MW, SR	Present in Archipelago during breeding season
White-winged Scoter	*Melanitta fusca*		SP, F, W	U	ASE, FW, MW, SSF, SR	Present in Archipelago during breeding season
Black Scoter	*Melanitta nigra*		SP, S, W, F	A (S-R)	ASE, FW, MW, SSF, SR	Present in Archipelago during breeding season
Long-tailed Duck	*Clangula hyemalis*		SP, F, W	U	MW, SR, RS, SGB	
Bufflehead	*Bucephala albeola*		SP, F, W	C	FW, MW	

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
Common Goldeneye	*Bucephala clangula*		SP, F, W	U	MW	
Barrow's Goldeneye	*Bucephala islandica*		F	+	MW, SR	
Smew	*Mergellus albellus*		SP	+	MW	
Hooded Merganser	*Lophodytes cucullatus*		W	+	FW, MW, SR	
Common Merganser	*Mergus merganser*		SP, S, W, F	C (S-U)	MW, RS, SR, SSF	Present in Archipelago during breeding season Cavity nester
Red-breasted Merganser	*Mergus serrator*		SP, S, W, F	C (S-U)	ASE, MW, RS, SR, SSF	Present in Archipelago during breeding season
Red-throated Loon	*Gavia stellata*		S	R	MW	Present in Archipelago during breeding season
Pacific Loon	*Gavia pacifica*		F	R	MW	
Common Loon	*Gavia immer*		SP, F, W	U	MW, SR	
Horned Grebe	*Podiceps auritus*		SP, F, W	C	MW	
Red-necked Grebe	*Podiceps grisegena*		SP, F, W	U	MW	
Double-crested Cormorant	*Phalacrocorax auritus*		SP, F, W	U	MW, RS, SR, SSF	Present in Archipelago during breeding season
Red-faced Cormorant	*Phalacrocorax urile*	A	F	R	MW, RS	Present in Archipelago during breeding season
Pelagic Cormorant	*Phalacrocorax pelagicus*		SP, S, W, F	C	MW, RS	Present in Archipelago during breeding season
Great Blue Heron	*Ardea herodias*		SP	+	FW, SR	
Bald Eagle	*Haliaeetus leucocephalus*	HI	SP, S, W, F	C (S-U)	FW, SR, MW, RS, SGB, SSF	Present in Archipelago during breeding season

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
Northern Harrier	*Circus cyaneus*		W	+	FW	Present in Archipelago during breeding season
Sharp-shinned Hawk	*Accipiter striatus*		F, W	R	ASE, SSF	Present in Archipelago during breeding season
Northern Goshawk	*Accipiter gentilis*	SS, A	SP, S, W, F	U	SSF	Present in Archipelago during breeding season
Rough-legged Hawk	*Buteo lagopus*		F	+	EFM, EG, FW	Only foraging habitat for fall migration
Golden Eagle	*Aquila chrysaetos*		SP, F, W	+	SR, EFM	Only foraging habitat for migration
Merlin	*Falco columbarius*		S, F, W	R	SSF	Present in Archipelago during breeding season
Gyrfalcon	*Falco rusticolus*		SP, W	+	ASE, EFM, EG, SR, SSF	Foraging habitat
Peregrine Falcon	*Falco peregrinus*	SS, A	SP, F, W	R	ASE, EFM, EG, FW, RS, SR	Foraging habitat
Sandhill Crane	*Grus canadensis*		F	+	FW, SGB	Foraging habitat
Pacific Golden- Plover	*Pluvialis fulva*		SP, S, F	U (S-R)	EG, FW, SGB	Present in Archipelago during breeding season
Semipalmated Plover	*Charadrius semipalmatus*		SP, S, F	C (F-R)	FW, SGB	Present in Archipelago during breeding season
Black Oystercatcher	*Haematopus bachmani*	A	SP, S, W, F	C	RS, EG, SGB	Present in Archipelago during breeding season

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
Spotted Sandpiper	*Actitis macularius*		S	R	ASE, AW, FW, SR	Present in Archipelago during breeding season
Wandering Tattler	*Tringa incana*		SP, S	C	SR, SGB	Present in Archipelago during breeding season
Greater Yellowlegs	*Tringa melanoleuca*		SP, S	R	FW, SGB	Present in Archipelago during breeding season
Lesser Yellowlegs	*Tringa flavipes*		S	R	FW, SGB	Present in Archipelago during breeding season
Whimbrel	*Numenius phaeopus*		S	R	FW, SGB	Present in Archipelago during breeding season
Ruddy Turnstone	*Arenaria interpres*		S	R	EG, RS, SGB	Present in Archipelago during breeding season
Black Turnstone	*Arenaria melancocephala*		SP, S, W, F	U (S-C)	EFM, EG, RS, SGB	Present in Archipelago during breeding season
Surfbird	*Aphriza virgata*		SP, S, F, W	U	EG, RS, SGB	Present in Archipelago during breeding season
Western Sandpiper	*Calidris mauri*		SP, S	R (S-C)	EFM, SGB	Present in Archipelago during breeding season
Least Sandpiper	*Calidris minutilla*		SP, S	U	FW, SGB	Present in Archipelago during breeding season
Baird's Sandpiper	*Calidris bairdii*		R	S	FW, SGB	Staging area.
Rock Sandpiper	*Calidris ptilocnemis*		SP, S, W, F	U (S-R)	RS, SGB	Present in Archipelago during breeding season

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
Dunlin	*Calidris alpina*		S	R	EFM, EG, FW, SGB, RS	Present in Archipelago during breeding season
Wilson's Snipe	*Gallinago delicata*		SP, S, F, W	U (W-+)	FW,	Present in Archipelago during breeding season
Franklin's Gull	*Larus pipixcan*		SP	+	FW, SGB, SR	Migrant
Bonaparte's Gull	*Larus philadelphia*		F	R	FW, MW, RS, SGB	Present in Archipelago during breeding season
Mew Gull	*Larus canus*		SP, S, W, F	A (S-C)	ASE, EFM, MW, RS, SGB, SR	Present in Archipelago during breeding season
Herring Gull	*Larus argentatus*		SP, S, F, W	R	EG, EFM, MW, RS, SGB, SR	Present in Archipelago during breeding season
Slaty-backed Gull	*Larus schistisagus*		F, W	+	MW, RS, SGB, SR	
Glaucous-winged Gull	*Larus glaucescens*		SP, S, W, F	A	FW, MW, RS, SGB, SR	Present in Archipelago during breeding season
Glaucous Gull	*Larus hyperboreus*		SP, F, W	R	FW, MW, RS, SGB, SR	Present in Archipelago during breeding season
Black-legged Kittiwake	*Rissa tridactyla*		SP, S, F, W	A (R-W)	MW, RS, SGB	Present in Archipelago during breeding season
Aleutian Tern	*Onychoprion aleuticus*	A	S	R	EFM, FW, MW, SR	Present in Archipelago during breeding season
Arctic Tern	*Sterna paradisaea*		SP, S	R (S-U)	FW, MW, RS, SGB, SR	Present in Archipelago during breeding season

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
Common Murre	*Uria aalge*		SP, F, W	R	MW	Present in Archipelago during breeding season
Thick-billed Murre	*Uria lomvia*		F	+	MW	Present in Archipelago during breeding season
Pigeon Guillemot	*Cepphus columba*		SP, S, W, F	C	MW	Present in Archipelago during breeding season
Marbled Murrelet	*Brachyramphus marmoratus*		SP, S, W, F	R	MW, SSF	Present in Archipelago during breeding season
Horned Puffin	*Fratercula corniculata*		SP, S, F	U	MW, RS	Present in Archipelago during breeding season
Tufted Puffin	*Fratercula cirrhata*		SP, S, F	U	MW, RS	Present in Archipelago during breeding season
Rock Pigeon	*Columba livia*		SP, S, F, W	C	DI	Present in Archipelago during breeding season
Boreal Owl	*Aegolius funereus*		SP	R	SSF	Present in Archipelago during breeding season
Belted Kingfisher	*Megaceryle alcyon*		SP, S, F, W	U	FW, SR, MW	Present in Archipelago during breeding season
Downy Woodpecker	*Picoides pubescens*		SP, S, F, W	U	ASE, AW, SSF	Present in Archipelago during breeding season
Northern Shrike	*Lanius excubitor*		SP, F, W	U	ASE, EW, FW, SSF	Present in Archipelago during breeding season

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
Black-billed Magpie	*Pica hudsonia*		SP, S, W, F	C	ASE, AW, SSF	Present in Archipelago during breeding season
Northwestern Crow	*Corvus caurinus*		SP, S, W, F	C	RS, SGB, SSF	Present in Archipelago during breeding season
Common Raven	*Corvus corax*		SP, S, W, F	C	SSF	Present in Archipelago during breeding season
Tree Swallow	*Tachycineta bicolor*		SP, S	U	ASE, AW, DI, FW, SR	Present in Archipelago during breeding season
Violet-green Swallow	*Tachycineta thalassina*		SP	U	ASE, AW, DI	Present in Archipelago during breeding season
Bank Swallow	*Riparia riparia*		SP, S	U	ASE, AW, SR	Present in Archipelago during breeding season
Cliff Swallow	*Petrochelidon pyrrhonota*		SP	+	DI, SR	Present in Archipelago during breeding season
Barn Swallow	*Hirundo rustica*		S	+	DI, FW, SR	Present in Archipelago during breeding season
Black-capped Chickadee	*Poecile atricapillus*		SP, S, W, F	C	ASE, SSF	Present in Archipelago during breeding season
Red-breasted Nuthatch	*Sitta canadensis*		SP, S, W, F	U	ASE, SSF	Present in Archipelago during breeding season
Brown Creeper	*Certhia americana*		SP, S, W, F	U	ASE, SSF	Present in Archipelago during breeding season

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
Winter Wren	*Troglodytes troglodytes*		SP, S, W, F	C	ASE, SSF	Present in Archipelago during breeding season
American Dipper	*Cinclus mexicanus*		SP, S, W, F	C	FW, SR, SGB	Present in Archipelago during breeding season
Golden-crowned Kinglet	*Regulus satrapa*		SP, S, W, F	C	SSF	Present in Archipelago during breeding season
Ruby-crowned Kinglet	*Regulus calendula*		F, W	R	ASE, SSF	Present in Archipelago during breeding season
Gray-cheeked Thrush	*Catharus minimus*		S	R	ASE, SSF	Present in Archipelago during breeding season
Hermit Thrush	*Catharus guttatus*		SP, S, W, F	A (F-C, W-+)	ASE, SSF	Present in Archipelago during breeding season
American Robin	*Turdus migratorius*		SP, F, W	R	ASE, AW, EFM, EG, SSF, SR, SGB	Present in Archipelago during breeding season
Varied Thrush	*Ixoreus naevius*		SP, S, W, F	C (W-U)	ASE, AW, EFM, EG, SSF, SR, SGB	Present in Archipelago during breeding season
European Starling	*Sturnus vulgaris*		F, W	+	ASE, AW, DI, EFM, EG, RS, SR, SGB	Present in Archipelago during breeding season
American Pipit	*Anthus rubescens*		S, F, W	U (W-+)	EFM, EG, SGB, SR	Present in Archipelago during breeding season
Orange-crowned Warbler	*Vermivora celata*		SP, S, W	C (F-R)	ASE, AW, SSF	Present in Archipelago during breeding season

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
Yellow Warbler	*Dendroica petechia*		SP, S, W	R (S-A, F-U)	ASE, AW	Present in Archipelago during breeding season
Yellow-rumped Warbler	*Dendroica coronata*		S	R	ASE, AW, SSF	Present in Archipelago during breeding season
Townsend's Warbler	*Dendroica townsendi*		F, W	+	SSF	Present in Archipelago during breeding season
Wilson's Warbler	*Wilsonia pusilla*		SP, S, F	U (S-A)	ASE, AW, SSF	Present in Archipelago during breeding season
American Tree Sparrow	*Spizella arborea*		SP, F, W	R	ASE, AW	Present in Archipelago during breeding season
Savannah Sparrow	*Passerculus sandwichensis*		SP, S, F, W	A (F-C, W-+)	EFM, EG	Present in Archipelago during breeding season
Fox Sparrow	*Passerella iliaca*		SP, S, F, W	A (S-C, W-R)	ASE, AW	Present in Archipelago during breeding season
Song Sparrow	*Melospiza melodia*		SP, S, W, F	C	ASE, AW, FW, RS, SR	Present in Archipelago during breeding season
Lincoln's Sparrow	*Melospiza lincolnii*		F, W	R	ASE, AW, FW	Present in Archipelago during breeding season
White-crowned Sparrow	*Zonotrichia leucophrys*		SP, F, W	R	ASE, AW, SSF	Present in Archipelago during breeding season
Dark-eyed Junco	*Junco hyemalis*		SP, F, W	U (SP-R)	ASE, AW, EFM, SSF	Present in Archipelago during breeding season

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
Lapland Longspur	*Calcarius lapponicus*		F	R	EFM, EG, FW	Present in Archipelago during breeding season
Snow Bunting	*Plectrophenax nivalis*		SP, W, F	R	DI, EFM, EG, RS, SGB	Present in Archipelago during breeding season
Rusty Blackbird	*Euphagus carolinus*		W	+	ASE, AW, DI, FW, SSF	Present in Archipelago during breeding season
Brambling	*Fringilla montifringilla*		F, W	+	ASE, AW, EFM	
Gray-crowned Rosy Finch	*Leucosticte tephrocotis*		SP, F, W	R	ASE, AW, EFM	Present in Archipelago during breeding season
Pine Grosbeak	*Pinicola enucleator*		SP, S, F, W	C	SSF	Present in Archipelago during breeding season
Red Crossbill	*Loxia curvirostra*		SP, S, F, W	U	SSF	Present in Archipelago during breeding season
White-winged Crossbill	*Loxia leucoptera*		SP, S, F, W	R	SSF	Present in Archipelago during breeding season
Common Redpoll	*Carduelis flammea*		SP, S, F, W	U	ASE, AW, EFM, EG, SSF	Present in Archipelago during breeding season
Pine Siskin	*Carduelis pinus*		SP, S, F, W	C	SSF	Present in Archipelago during breeding season
			Mammals			
Brown Bear	*Ursus arctos*	HI	SP, S, F	C	ASE, AW, SR, SSF	
Red Fox	*Vulpes vulpes*		SP, S, F, W		ASE, AW, EFM, FW, RS, SSF	

Table C-1. Wildlife Species Known to Occur in the Airport Study Area and Landscape Area

Common Name	Scientific Name	Conservation Status	Seasonality	Relative Abundance	Habitat	Comments
American Beaver	*Castor canadensis*	HI			FW, SR	
Long-tailed Weasel	*Mustela frenata*		SP, S, F, W		ASE, AW, EFM, SR	
Arctic Ground Squirrel	*Spermophilus parryii*	HI	S	U	ASE, AW, EFM, SR	
Sitka Black-tailed Deer	*Odocoileus hemionus sitkensis*	HI	SP, S, F, W	U	ASE, AW, EFM, SSF	
River Otter	*Lontra canadensis*		Sp, S, F, W	U	MW, SR	

SS= Alaska Department of Fish and Game (ADF&G) Species of Special Concern
A = Alaska Watch Audubon List
HI = High Interest Species

SP = Spring
S = Summer
F = Fall
W = Winter

A – abundant – Species is very numerous in all proper habitat; the area regularly hosts great numbers of the species; sighting likelihood excellent.
C – common -Species occurs regularly in most proper habitat; sighting likelihood good.
U – uncommon -Species usually present in relatively small numbers, or higher numbers unevenly distributed; sighting likelihood fair to poor.
R – rare -Species occurs regularly in the area but in very small numbers; sighting likelihood poor.
+ - casual or accidental - Species has been recorded no more than a few times; usually occurs singly; sighting likelihood very poor.

EG = Elymus Grassland
EFM = Elymus Forb Meadow
AWM = Alder-Willow Mix
ASE = Alder-Salmonberry-Elderberry
DI = Disturbed
FW = Freshwater Wetland
MW = Marine Water
SR = Streams & Rivers
RS = Rocky Shore
SSF = Sitka Spruce Forest
SGB = Sand & Gravel Beach

Rare Plant Survey Technical Report for Kodiak Airport Environmental Impact Statement, Kodiak, Alaska

Prepared for

Federal Aviation Administration

Prepared by

SWCA Environmental Consultants

April 2012

RARE PLANT SURVEY TECHNICAL REPORT FOR KODIAK AIRPORT ENVIRONMENTAL IMPACT STATEMENT, KODIAK, ALASKA

Prepared for

Federal Aviation Administration

Prepared by

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1220 SW Morrison Street
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April 4, 2012

CONTENTS

APPENDICES

FIGURES

TABLES

INTRODUCTION

This report summarizes the results of a rare plant survey conducted by SWCA Environmental Consultants (SWCA) in support of an environmental impact statement (EIS) that is currently being prepared for proposed expansion of runway safety areas (RSAs) at the Kodiak Airport in Kodiak, Alaska.

In late summer 2010, three species listed on the Alaska Rare Plant List by the Alaska Natural Heritage Program (ANHP; Appendix A) were documented by Stacy Studebaker, an independent naturalist with extensive botanical experience in the Kodiak Island Archipelago, in the Buskin River estuary adjacent to the Kodiak Airport: 1) sessileleaf scurvygrass (*Cochlearia sessilifolia*), 2) Oriental popcornflower (*Plagiobothrys orientalis*), and 3) Alaska mistmaiden (*Romanzoffia unalaschcensis*). It was determined that some rare plant populations documented in the 2010 survey could be impacted by alternatives proposed to improve the safety area at the north end of Runway18/36. SWCA conducted fieldwork in 2011 to further delineate the presence and extent of these species as authorized by Federal Aviation Administration (FAA), the lead federal agency for the EIS.

Project Location and Description

Kodiak Island is in the northwestern Gulf of Alaska, south of the Alaska Peninsula. The island is the largest in the Kodiak Island Archipelago. The Kodiak Airport is on the northeastern shore of Kodiak Island within the Buskin River watershed and along a shallow-water portion of Chiniak Bay where depths are less than 300 feet (Figure 1). The Buskin River watershed covers approximately 26 square miles and ranges in elevation from nearly 2,250 feet at Barometer Mountain to sea level at St. Paul Harbor. The Buskin River is approximately 6.5 miles long and flows southeast to enter Chiniak Bay at St. Paul Harbor, immediately north of the Airport. Devils Creek, the dominant stream in a sub-watershed within the larger Buskin River watershed, flows through the Airport and enters the Buskin River from the south; from the north, the significant tributaries are short streams draining from Lakes Catherine, Louise, and Genevieve.

The airport *study area* consists of the existing airport property and surrounding areas with potential to be affected by one or more of the proposed actions and alternatives; the *landscape area* includes the study area and suitable rare plant habitat within Womens Bay, a large glacial inlet within Chiniak Bay, and its tributaries (Figure 1). Within the study area, the Buskin River and Devils Creek are the freshwater bodies most likely to be directly impacted by the project.

Environmental Setting

The study area is located in the Kodiak Island Archipelago (Nowacki et al. 2001). This rugged, fjord-carved island complex is a geologic extension of the Chugach Mountains and has similar folded and faulted sedimentary rocks of Pacific origin. During past glaciations, ice engulfed most of the islands except for the highest mountains and some seaward coastal plains, providing refugia for plant and animal life. Today, high sharp peaks with cirque glaciers and low rounded ridges overtop glacially scoured valleys covered with till or lacustrine deposits. Large terminal moraines occur offshore where many former glaciers extended onto the continental shelf. The flora of this archipelago has been greatly influenced by past glaciation. Today luxuriant forb/grass meadows and willow and alder thickets cover the majority of these islands. Sitka spruce and black cottonwoods have only recently managed to regain a foothold on previously glaciated lands and alpine tundra exists at higher elevations. The archipelago experiences a cool, wet maritime climate with minimal seasonal temperature variation and extended periods of overcast clouds, fog, and precipitation.

The study area consists of a variety of land cover types, including Sitka spruce forest, alder-willow, alder-salmonberry-elderberry, Elymus forb meadow (maintained airfield lands), Elymus grassland, sedge marsh, freshwater wetlands, sand and gravel beach, rocky shore, rivers and streams, marine waters, and disturbed lands (SWCA 2009a). A more detailed description of riparian and aquatic vegetation within the study area and adjacent lands is provided in SWCA's technical reports dealing with terrestrial and marine vegetation and wildlife (SWCA 2009a, 2009b).

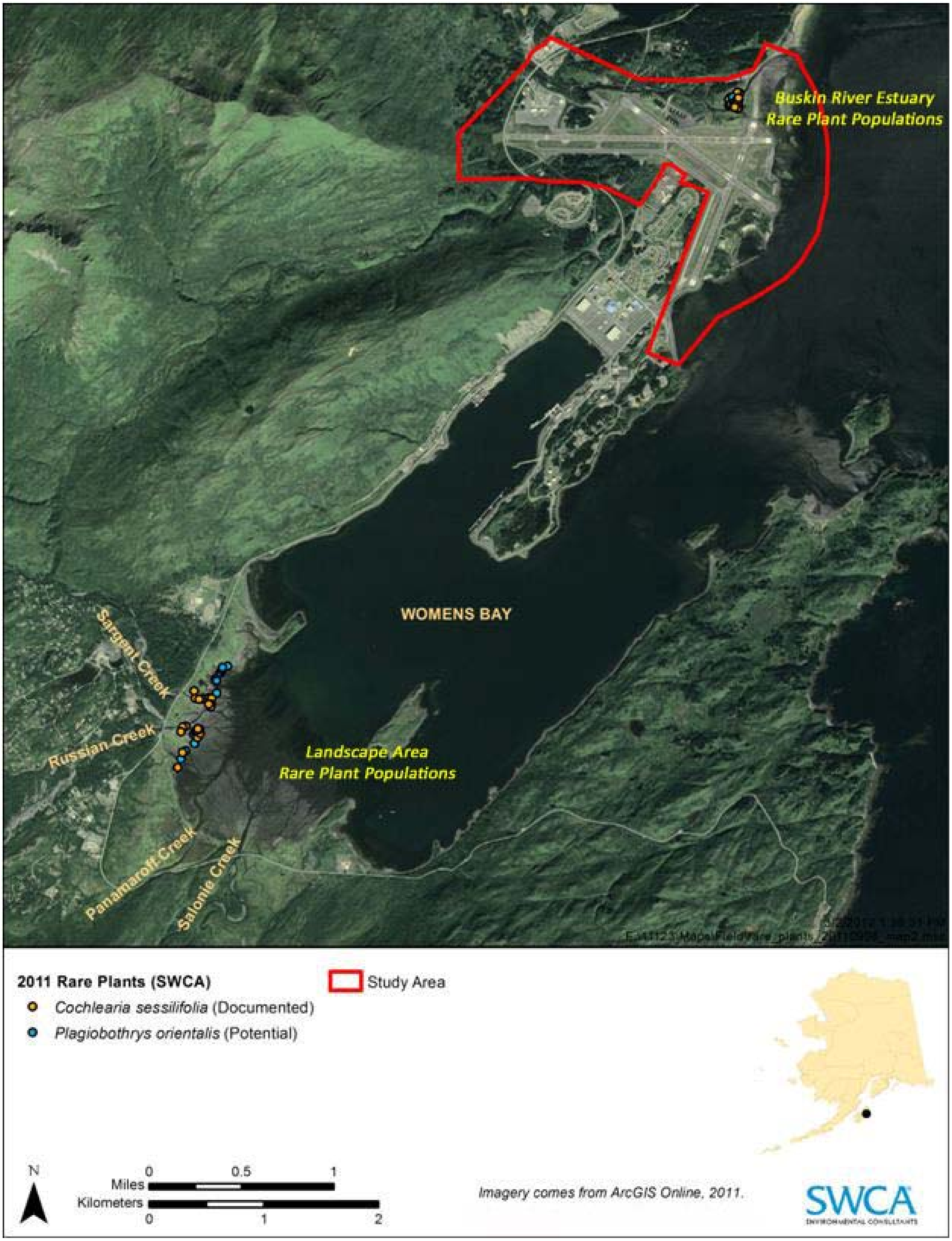

Figure 1. Rare plant locations in the study and landscape areas.

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State Regulations

The State of Alaska maintains an endangered species list for animals but does not maintain a state-level endangered plant list. However, the ANHP at University of Alaska, Anchorage, maintains and updates a list of vascular plant species and lichens that are rare in Alaska (ANHP 2012). These plants are assigned conservation status ranks that adhere to protocols developed by NatureServe, a nonprofit conservation organization that partners with a network of natural heritage programs to maintain and house information about rare and endangered species and threatened ecosystems. Status assessments are based on the best available information and consider a variety of factors such as species abundance, distribution, population trends, and threats. Rare plants considered in this report are ranked at the global level (‘G’) and at the state level in Alaska (‘S’) as follows:

- **G1 or S1: Critically imperiled** at the global or state level because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state.
- **G2 or S2: Imperiled** at the global or state level because of rarity due to very restricted range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from state.
- **G3 or S3: Vulnerable** at the global or state level due to a restricted range, relatively few populations, recent and widespread declines, or other factors making it vulnerable to extirpation.
- **Q: Questionable taxonomy that may reduce conservation** priority. The “Q” modifier is used when the distinctiveness of a taxon or ecosystem type at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon or type in another taxon or type, with the resulting taxon having a lower-priority (numerically higher) conservation status rank.

Rare, Threatened, and Endangered Plants

Threatened and Endangered Plants

The only plant federally listed or proposed for listing by the U.S. Fish and Wildlife Service in Alaska is Aleutian holly fern (*Polystichum aleuticum*), which is endangered. It is only known from Adak Island and is not expected to occur anywhere on Kodiak Island.

Rare Plants

According to results of the 2010 field survey and the 2008 ANHP rare plant list (see Appendix A), three rare vascular plants are known to occur within or adjacent to the study area: sessileleaf scurvygrass, Oriental popcornflower, and Alaska mistmaiden. Information regarding habitat requirements, ANHP state and global rankings for each species and the occurrence of these species within the project area is presented below.

Sessileleaf scurvygrass

Sessileleaf scurvygrass, an annual forb in the mustard (Brassicaceae) family, is endemic to Kodiak and Sitkalidak islands in south-coastal Alaska. It occurs in gravel bars in the intertidal zone and is submersed at high tide. There remains some question as to the appropriate taxonomy for this species because it is similar and possibly conspecific with spoonwort (*C. officinalis*; Rollins 1993). Consequently, the ANHP rank for sessileleaf scurvygrass was revised from G1G2Q/S1S2 to G1G2Q/S2Q in February 2012 (personal communication, Helen Cortés-Burns, February 16, 2012). The revised ranking indicates the species is considered either “critically imperiled” or “imperiled” across its global distribution, and “imperiled” at the state geographic level. However, the Q (“questionable”) rating for both the global and state rankings indicates that there are unanswered questions regarding the distinctiveness of its taxonomy. As of February 2012, sessileleaf scurvygrass is not a federally listed species, and there are no state protections for this species. In accordance with FAA Orders 1050.1E and 5050.4B, the EIS for proposed RSA improvements at Kodiak Airport will 1) consider the potential impacts on biological resources including sessileleaf scurvygrass, and 2) describe the requirements for compliance with laws pertaining to federally listed and state-listed plant and animal species.

Oriental popcornflower

Oriental popcornflower, a perennial herb in the borage (*Boraginaceae*) family, is known from scattered freshwater wetland sites in south-coastal Alaska and extending to Kamchatka and the Commander Islands in the Russian Far East. The ANHP ranking for this species indicates that it is considered either “vulnerable” (G3) or “apparently secure” (G4) at the global level and “vulnerable” (S3) at the state geographic level. This species is not currently protected. As was described for sessileleaf scurvygrass, possible impacts to Oriental popcornflower and regulatory compliance requirements will be disclosed in the Kodiak Airport EIS.

Alaska mistmaiden

Alaska mistmaiden, a small herbaceous perennial in the waterleaf (Hydrophyllaceae) family, is endemic to the eastern Aleutians, Alaska Peninsula, Kodiak Island, and scattered locations east to Sitka. It occurs in moist to wet river banks, beach terraces, and rock crevices. The ANHP rank for this species indicates that the species is currently considered “vulnerable” (G3) at the global level and “vulnerable” (S3) at the state level. This ranking is currently under review and expected to be revised to G3/S3S4 (personal communication, Helen Cortés-Burns, February 20, 2012). This species is not currently protected. As was described for sessileleaf scurvygrass, possible impacts to Alaska mistmaiden and regulatory compliance requirements will be disclosed in the Kodiak Airport EIS.

METHODS

A field visit was conducted on August 28 and 29, 2011, by SWCA botanist J. Hope Hornbeck and SWCA field assistant Stacey Reed. The primary objective of the 2011 survey was to confirm the distribution of sessileleaf scurvygrass in the study and landscape areas; therefore, the survey was conducted during the flowering period for this species. Rare plant habitat within the study area and potential rare plant habitats within the landscape area were surveyed for sessileleaf scurvygrass, Oriental popcornflower, and Alaska mistmaiden. Pedestrian surveys were conducted during morning low-tide events. Based on previous data collected by Stacy Studebaker in 2010 (Figure 2), SWCA identified potential rare plant habitats and known rare plant populations to be surveyed. These habitats were surveyed on foot, with particular focus on preferred habitats of sessileleaf scurvygrass and Oriental popcornflower, which consist of sparsely vegetated mudflats. A Trimble GPS unit was used to document plant locations in the study area for mapping purposes. In the study area, rare plant habitat areas were estimated as a circumference around the center of a concentration of individual plants. A rough estimate of the number of individual plants in each habitat area was also recorded. In Womens Bay, rare plant occurrences and habitat areas were mapped as points at the center of plant concentrations. The survey results were mapped with the general habitat areas in the Buskin River shown as circular areas of the recorded circumference (Figure 2). The number and density of plants is not included in the figure.

The survey was floristic in nature, whereby all species were identified to species and subspecies or variety where appropriate. Species that could not be identified in the field were collected and further examined for positive identification in a laboratory setting. Taxonomic identifications followed Hultén (1968), Pojar and MacKinnon (1994), and Studebaker (2010). Taxonomic nomenclature and common names of plants follow the PLANTS Database (USDA NRCS 2012). Detailed photographs were taken to provide a visual reference for study area features and subjects of unique botanical interest.

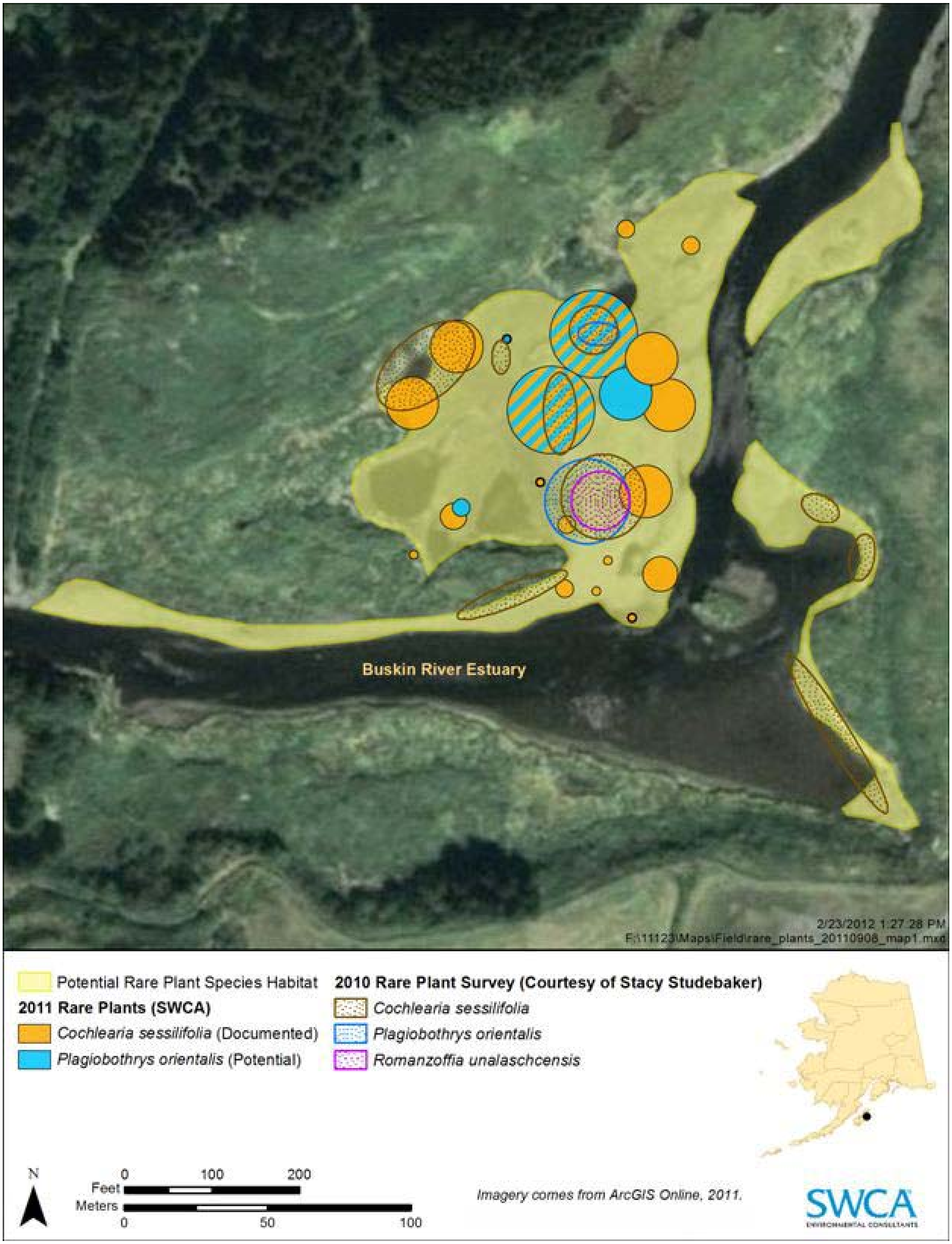

Figure 2. 2010 and 2011 Buskin River Estuary rare plant locations within the study area.

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Table 1. Plant Species Recorded on August 28 and 29, 2011

Scientific Name	Common Name	Habitat
Atriplex gmelinii	Gmelin's saltbush	Rivers and streams (tidal)
Bromus sitchensis	Alaska brome	Sedge marsh
Carex lyngbyei	Lyngbye's sedge	Sedge marsh
Chamerion angustifolium	Fireweed	Elymus forb meadow
Cochlearia sessilifolia	Sessileleaf scurvygrass	Rivers and streams (tidal)
Equisetum sp.	Horsetail	Sedge marsh
Geranium erianthum	Woolly geranium	Elymus forb meadow
Geum macrophyllum	Largeleaf avens	Elymus forb meadow
Honckenya peploides	Seaside sandplant	Rivers and streams (tidal)
Ligusticum scoticum	Scottish licorice-root	Elymus forb meadow
Matricaria discoidea	Disc mayweed	Elymus forb meadow
Montia fontana	Annual water minerslettuce	Rivers and streams (tidal)
Plantago major	Common plantain	Elymus forb meadow
Plantago maritima	Goose tongue	Rivers and streams (tidal)
Poa eminens	Largeflower speargrass	Elymus forb meadow
Polygonum aviculare	Prostrate knotweed	Elymus forb meadow
Potentilla sp.	Cinquefoil species	Rivers and streams (tidal)
Puccinellia nutkaensis	Nootka alkaligrass	Sedge marsh
Rumex crispus	Curly dock	Elymus forb meadow
Rumex salicifolius	Willow dock	Elymus forb meadow
**Spergularia canadensis*	Canadian sandspurry	Rivers and streams (tidal)
Spergularia rubra	Red sandspurry	Rivers and streams (tidal)
Stellaria humifusa	Saltmarsh starwort	Rivers and streams (tidal)
Trifolium repens	White clover	Elymus forb meadow
Triglochin maritimum	Seaside arrowgrass	Rivers and streams (tidal)

* Identified by Studebaker (personal communication, January 19, 2012)

RESULTS

Rare plant habitat within the study area predominantly consists of salt marsh dominated by Lyngbye's sedge (*Carex lyngbyei*), vegetated mudflats dominated by seaside sandplant (*Honckenya peploides*), and a sparsely vegetated intertidal zone. In addition, upland benches and sand bars near estuarine habitats along the Buskin River contain a combination of native grasses and forbs and non-native plant species. Because sessileleaf scurvygrass occurs in intertidal habitats, it is subject to tidal inundation and shifting of the surrounding mudflats twice daily. Strong tidal events occurred during the survey, and individual plants were noted to be freshly buried or removed by tidal action. No direct or ongoing disturbance to individual plants from any other causes was noted. Table 1 provides a list of plant species recorded during the survey.

SWCA surveys of the study area and of Russian Creek and Sargent Creek estuaries in Womens Bay were conducted before midday high tides on August 28 and 29, 2011. Salonie Creek estuarine beaches were not surveyed due to bear activity on both days. Surveys were conducted while sessileleaf scurvygrass was in flower. However, Oriental popcornflower and Alaska mistmaiden were not flowering and were unidentifiable at the time of SWCA's 2011 field survey. A detailed discussion of known or suspected occurrences of these species within the study area and in suitable habitats within the landscape area is presented below. Locations of potential and known rare plant occurrences within the landscape and study areas are presented in Figure 1. Potential rare plant habitat and known occurrences within the Buskin River estuary in the study area are presented in Figure 2. Potential impacts to these species resulting from the proposed project and management recommendations are not addressed in this report, but will be described in the *Kodiak Airport Environmental Impact Statement*.

Sessileleaf Scurvygrass

Within the study area, dense concentrations of sessileleaf scurvygrass were documented in sheltered areas to the north and south of the Buskin River within the Buskin River estuary in 2010 (Figure 2). During the 2011 survey, SWCA verified populations documented in 2010 and located additional plants within the Buskin River estuary to the north of the Buskin River (Figure 2). SWCA was unable to re-locate plants previously identified along the south side of the river (see Figure 2). Because this plant is an annual species, all suitable habitat within the estuary may support individuals of this population. Due to the dynamic forces of the estuary, its distribution within suitable habitat would likely vary from year to year. Within the landscape area, SWCA identified scattered patches of sessileleaf scurvygrass at the mouths of Sargent Creek and Russian Creek. Although SWCA did not survey suitable habitat for this species at the mouth of Panamaroff Creek and Salonie Creek, habitats are similar, and it is assumed that this species occurs there as well. This species may be more common in the more sheltered Buskin River estuary than in more open habitats of Womens Bay, which are more exposed to wind and tidal wave action. Because of the constant disturbance and shifting of the substrate in these tidal habitats, all suitable tidally influenced habitats for this species in the Buskin River estuary should be considered potential sessileleaf scurvygrass habitat.

Figure 3. Sessileleaf scurvygrass (*Cochlearia sessilifolia*) in flower and fruit in the study area, August 28, 2011.

Figure 4. Close-up of sessileleaf scurvygrass in flower and fruit in the study area, August 28, 2011.

Note the lack of basal leaves, wedge-shaped leaf bases that attach directly to the stem, and elongate fruits. These features distinguish *Cochlearia sessilifolia* from *C. groenlandica*, which has a basal rosette of leaves, distinctly stemmed kidney-shaped leaf bases, and orbicular fruits (Parker 2011; Rollins 1993).

Oriental Popcornflower

During 2010 surveys, Oriental popcornflower was identified in the same habitat as sessileleaf scurvygrass in the Buskin River estuary (personal communication, Stacy Studebaker 2011; Figure 2). During field surveys in 2011, SWCA was unable to verify the identification of this species within the study area or in suitable habitat in Womens Bay. SWCA's survey was conducted later in the season, at a time when this species was no longer in flower and had likely desiccated. However, it is assumed that the populations observed in 2010 in the Buskin River estuary still exist. SWCA identified potential habitat for this species throughout the Buskin River estuary and found similar habitat in Womens Bay estuary at the mouths of Sargent Creek and Russian Creek (Figures 1 and 5). Although SWCA did not survey suitable habitat for this species at the mouth of Panamaroff Creek and Salonie Creek, habitats are similar to those surveyed and it is assumed that this species occurs there as well. Because of the constant disturbance and shifting of the substrate in these tidal habitats, all suitable tidally influenced habitats for this species in the Buskin River estuary should be considered potential Oriental popcornflower habitat.

Figure 5. Sessileleaf scurvygrass and Oriental popcornflower habitat in Womens Bay.

Alaska Mistmaiden

During the 2010 survey, Alaska mistmaiden was identified to the north of the Buskin River within the Buskin River estuary within the study area. During field surveys in 2011, SWCA was unable to re-locate the population identified in 2010 and did not locate any additional populations. SWCA's survey was conducted later in the season, at a time when this species was no longer in flower and had likely desiccated. However, it is assumed that the population observed in 2010 in the Buskin River estuary still exists (see Figure 2). This species was located at a higher elevation than sessileleaf scurvygrass and Oriental popcornflower and is not submerged on a daily basis by tidal influences. Surveys conducted in Womens Bay estuary at the mouths of Sargent Creek and Russian Creek were not focused on Alaska mistmaiden or its habitat.

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Appendix A

Alaska Natural Heritage Program Rare Vascular Plant Tracking List April 2008

ALASKA NATURAL HERITAGE PROGRAM
RARE VASCULAR PLANT TRACKING LIST
APRIL 2008

Scientific Name	Global Rank	State Rank
Abies amabilis	G5	S3
Agoseris aurantiaca	G5	S1S2
Agoseris glauca	G5	S2
Agrostis clavata	G4G5	S1S2
Agrostis thurberiana	G5	S2
Allium victorialis	G5	S1
Alyssum obovatum	G5?	S2S3
Ambrosia chamissonis	G4G5	S1S2
Antennaria densifolia	G3	S2
Antennaria dioica	G5	S2S3
Aphragmus eschscholtzianus	G3	S3
Apocynum androsaemifolium	G5	S2S3
Arabidopsis salsuginea	G4G5	SP
Arenaria longipedunculata	G3Q	S3
Arnica diversifolia	G5	S1
Arnica lessingii ssp. *norbergii*	G5T2Q	S2
Arnica lonchophylla	G4	S1S2
Arnica mollis	G5	S1
Artemisia aleutica	G1	S1
Artemisia arctica ssp. *beringensis*	G5T3?	S2S3
Artemisia dracunculus	G5	S1S2
Artemisia globularia var. *lutea*	G4T1T2	S1S2
Artemisia michauxiana	G4G5	SP
Artemisia rupestris ssp. *woodii*	G3?T2	SP
Artemisia senjavinensis	G3	S2S3
Artemisia stelleriana	G4?	S1
Artemisia tanacetifolia	G4?	S2
Artemisia tilesii ssp. *unalaschcensis*	G5T3Q	S3
Artemisia unalaskensis var. *aleutica*	GNRT2T3Q	S2S3
Asplenium trichomanes	G5	S1
Asplenium trichomanes-ramosum	G4	S3
Astragalus agrestis	G5	SP
Astragalus robbinsii ssp. *harringtonii*	G5T3	S3
Astragalus williamsii	G4	S2S3
Betula papyrifera var. *commutata*	G5T5	S2
Blysmopsis rufa	G5	S1
Boechera calderi	G4?	S1
Boechera drepanoloba	G4?	S1?

Scientific Name	Global Rank	State Rank
Boechera lemmonii	G5 S1	
Boechera lyallii	G5 S1	
Bolboschoenus maritimus	G5 S2?	
Boschniakia hookeri	G5 SP	
Botrychium alaskense	G2G3 S2S3	
Botrychium ascendens	G2G3 S2	
Botrychium lineare	G1 S1	
Botrychium montanum	G3 S1	
Botrychium pedunculosum	G2G3 S1	
Botrychium robustum	G4G5 S1S2	
Botrychium spathulatum	G3 S1	
Botrychium tunux	G1 S2	
Botrychium virginianum	G5 S2	
Botrychium yaaxudakeit	G2 S2	
Brasenia schreberi	G5 S1	
Campanula aurita	G4 S3S4	
Campanula scouleri	G5 S1	
Cardamine angulata	G5 S3	
Carex adelostoma	G4 S1	
Carex atherodes	G5 S3	
Carex athrostachya	G5 S1S2	
Carex atratiformis	G5 S2	
Carex bebbii	G5 S1	
Carex brunnescens ssp. *alaskana*	G5T3T4 S2S4	
Carex crawfordii	G5 S3	
Carex deflexa	G5 S1S2	
Carex deweyana	G5 S2?	
Carex eburnea	G5 S3	
Carex echinata ssp. *echinata*	G5T5 S1S2	
Carex glareosa ssp. *pribylovensis*	G4G5T2T3 S2S3	
Carex heleonastes	G4 S2S3	
Carex holostoma	G4? S3	
Carex hoodii	G5 S1	
Carex interior	G5 S1	
Carex lapponica	G4G5Q S2	
Carex laxa	G5? S1S2	
Carex leptalea ssp. *pacifica*	G5T4T5 S1S2	
Carex parryana	G4 S1	
Carex phaeocephala	G4 S3	
Carex praegracilis	G5 S1	
Carex preslii	G4 S1	
Carex sabulosa	G5 S1	
Carex sartwellii var. *sartwellii*	G4G5T4T5 S1	
Carex sprengelii	G5? S1	
Carex stipata	G5 S1	
Carex sychnocephala	G4 S1	

Scientific Name	Global Rank	State Rank
Carex tahoensis	G3G4Q	S1
Carex xerantica	G5	S1S2
Cassiope lycopodioides var. *cristapilosa*	G4T2	S1
Castilleja hyetophila	G4G5	S2S4
Castilleja parviflora	G5?	S2S4
Catabrosa aquatica	G5	S1
Cerastium aleuticum	G3	S3
Cerastium maximum	G4	S3
Cerastium regelii	G4	S3
Ceratophyllum demersum	G5	S1
Chamaerhodos erecta ssp. *nuttallii*	G5T4	S1S2
Chenopodium salinum	G5	S1
Chimaphila umbellata ssp. *occidentalis*	G5T5	S3
Chrysosplenium rosendahlii	G3?	S1S2
Cicuta bulbifera	G5	S2
Cirsium edule	G4	S1
Cirsium foliosum	G5	SR
Cirsium kamtschaticum	G3?	S2S3
Claytonia arctica	G3	S1
Claytonia ogilviensis	G1	SP
Cochlearia sessilifolia	G1G2Q	S1S2
Corispermum ochotense	G3G4	S3
Crassula aquatica	G5	S3
Crataegus douglasii var. *douglasii*	G5T4	S1S2
Cryptantha shackletteana	G1Q	S1
Cryptogramma stelleri	G5	S2S3
Cypripedium montanum	G4	S1
Cypripedium parviflorum	G5	S2S3
Dactylorhiza aristata var. *kodiakensis*	G4T2T3	S2S3
Danthonia spicata	G5	S1
Douglasia alaskana	G3	S3
Douglasia arctica	G3	S2S3
Douglasia beringensis	G2	S2
Douglasia gormanii	G4	S3
Draba aleutica	G2	S2
Draba densifolia	G5	S1
Draba incerta	G5	S2S3
Draba kamtschatica	G3Q	S2?
Draba lonchocarpa var. *thompsonii*	G5T3T4Q	S1
Draba micropetala	G4	S1S2
Draba murrayi	G2	S2
Draba ogilviensis	G2	S2
Draba pauciflora	G4	S1
Draba paysonii	G5	SR
Draba praealta	G5	SR
Draba ruaxes	G3	S3

Scientific Name	Global Rank	State Rank
Draba subcapitata	G4	S1
Dulichium arundinaceum	G5	S1
Eleocharis kamtschatica	G4	S2S3
Eleocharis nitida	G3G4	S1
Eleocharis quinqueflora	G5	S1
Elymus calderi	G3G4	S2S3
Epilobium leptophyllum	G5	SP
Erigeron acris ssp. *kamtschaticus*	G5T4T5	S1
Erigeron glacialis	G4G5	S2S3
Erigeron muirii	G2	S2
Erigeron ochroleucus	G5	S1S2
Erigeron porsildii	G3G4	S3
Erigeron yukonensis	G2G4	S1
Eriogonum flavum var. *aquilinum*	G5T2	S2
Eriophorum viridicarinatum	G5	S2
Erysimum asperum var. *angustatum*	G5T2	S1S2
Festuca edlundiae	G3G4	S1
Festuca lenensis	G4G5	S3
Festuca minutiflora	G5	S1
Festuca occidentalis	G5	S1
Filipendula kamtschatica	G3G4	SR
Galium kamtschaticum	G5	S2
Gaultheria miqueliana	G3G4	S1
Gentianella auriculata	G4G5	S1
Gentianella propinqua ssp. *aleutica*	G5T2T4	S2S4
Gentianopsis detonsa ssp. *detonsa*	G3G5T3T5	S1
Geum aleppicum var. *strictum*	G5T5	S1S2
Geum pentapetala	G3G4	S2S3
Geum schofieldii	G2Q	SP
Glehnia littoralis ssp. *leiocarpa*	G5T5	S3
Glyceria leptostachya	G3	S2
Glyceria pulchella	G5	S2S3
Glyceria striata var. *stricta*	G5T5Q	S2
Hymenophyllum wrightii	G4?	S2S3
Isoetes occidentalis	G4G5	S1S2
Isolepis cernua	G5	S1
Juncus articulatus	G5	S1
Juncus nodosus	G5	S2
Juncus tenuis	G5	S2S3
Juniperus horizontalis	G5	S1S2
Koeleria asiatica	G4	S2S3
Koeleria macrantha	G5	S1
Lactuca biennis	G5	S1S2
Lathyrus ochroleucus	G4G5	S1
Lathyrus venosus var. *intonsus*	G5T5	S1
Lewisia pygmaea	G5	SP

Scientific Name	Global Rank	State Rank
Ligusticum calderi	G3	S1
Limosella aquatica	G5	S3
Listera convallarioides	G5	S2
Lobelia dortmanna	G4G5	S1
Lonicera involucrata	G4G5	S2
Lupinus kuschei	G3	S2
Lupinus lepidus	G5	S1?
Luzula comosa	G4G5	S1
Lycopodiella inundata	G5	S3
Lycopus americanus	G5	S1
Lycopus uniflorus	G5	S3
Maianthemum racemosum	G5	S2
Maianthemum stellatum	G5	S2
Malaxis paludosa	G4	S3
Melica subulata	G5	S1
Mertensia drummondii	G2	S2
Mertensia eastwoodiae	G3	S3
Mertensia paniculata var. *alaskana*	G5T3	S3?
Mimulus lewisii	G5	S2
Mimulus tilingii	G5	S1
Minuartia yukonensis	G4?	S3
Mitella nuda	G5	S2
Mitella trifida	G5	S2
Monotropa uniflora	G5	S1S2
Montia bostockii	G3	S3
Myriophyllum farwellii	G5	S1
Myriophyllum verticillatum	G5	S3
Najas flexilis	G5	S1S2
Ophioglossum pusillum	G5	SH
Orobanche fasciculata	G4	S1S2
Orobanche uniflora	G5	S2
Oxytropis arctica var. *barnebyana*	G4?T2Q	S2
Oxytropis huddelsonii	G3	S2S3
Oxytropis kobukensis	G2	S2
Oxytropis kokrinensis	G3	S3
Oxytropis tananensis	G2G3Q	S2S3
Packera moresbiensis	G3	S2S3
Papaver alboroseum	G3G4	S3
Papaver gorodkovii	G3	S2S3
Papaver nudicaule ssp. *americanum*	G4G5T4T5	S3
Papaver walpolei	G3	S3
Parasenecio auriculata	G2	S2
Parrya nauruaq	G2	S2
Pedicularis groenlandica	G4G5	S1S2
Pedicularis hirsuta	G5?	S1
Pedicularis macrodonta	G4Q	S3

Scientific Name	Global Rank	State Rank
Penstemon serrulatus	G4 S1	
Phacelia franklinii	G5 S2S3	
Phacelia mollis	G2G3 S2S3	
Phacelia sericea	G5 S2	
Phalaris arundinacea	G5 S3SE	
Phippsia concinna	G4 S1	
Phlox hoodii	G5 S2	
Phyllodoce empetriformis	G5 S1S2	
Phyllospadix serrulatus	G4 S2	
Physaria calderi	G3G4 S2	
Physocarpus capitatus	G5 S2S3	
Picris hieracioides	G5 S1S2	
Pinus contorta var. *latifolia*	G5T5 S3	
Piperia unalascensis	G5 S2	
Plagiobothrys orientalis	G3G4 S3	
Plantago major var. *pilgeri*	G5TUQ S2S3	
Platanthera gracilis	G3G5Q S2?	
Platanthera orbiculata	G5 S2	
Platanthera tipuloides var. *behringiana*	G4G5T2? S2?	
Pleuropogon sabinei	G4G5 S1	
Poa hartzii ssp. *alaskana*	G3G4T1 S1	
Poa laxiflora	G3G4 S2S3	
Poa leptocoma	G5 S2	
Poa macrantha	G5T5 S1	
Poa occidentalis	G4 SR	
Poa porsildii	G3 S2S3	
Poa secunda ssp. *juncifolia*	G5TNR S1	
Poa secunda ssp. *secunda*	G5TNR S1	
Podistera yukonensis	G2 S1	
Polygonum boreale	G3G4 S2S4	
Polygonum hydropiperoides	G5 S1	
Polygonum minimum	G5 S1	
Polypodium sibiricum	G5? S2	
Polystichum aleuticum	G1 S1	
Polystichum kruckebergii	G4 S1	
Polystichum microchlamys	G4? S1	
Polystichum setigerum	G2G3 S2S3	
Potamogeton obtusifolius	G5 S2S3	
Potamogeton robbinsii	G5 S1S2	
Potamogeton subsibiricus	G3 S3	
Potentilla drummondii	G5 S2	
Potentilla fragiformis	G4 S1S2	
Potentilla rubricaulis	G4 S2?	
Potentilla stipularis	G5 S1	
Primula cuneifolia ssp. *cuneifolia*	G5T3T4 S1S2	

Scientific Name	Global Rank	State Rank
Primula tschuktschorum	G2G3	S2S3
Puccinellia angustata	G4Q	S3S4
Puccinellia arctica	G2Q	S1
Puccinellia vaginata	G4	S1?
Puccinellia vahliana	G4	S2S3
Puccinellia wrightii	G3G4	S2S3
Ranunculus auricomus	G5	S2
Ranunculus gelidus var. *shumaginensis*	G4T1Q	S1
Ranunculus glacialis var. *1 (cf.* var. *glacialis)*	G4T2	S2
Ranunculus glacialis var. *chamissonis*	G4T3T4	S2
Ranunculus kamchaticus	G4G5	S2S3
Ranunculus pacificus	G3	S3
Ranunculus sabinei	G4	S1
Ranunculus turneri	G2G3	S2
Romanzoffia unalaschcensis	G3	S3
Rorippa curvisiliqua	G5	S1
Rorippa nasturtium-aquaticum	GNR	S1S2
Rorippa obtusa	G5	S1
Rosa woodsii var. *woodsii*	G5T5	S1S2
Rumex beringensis	G3	S3
Rumex graminifolius	G4?	S1
Rumex krausei	G2	S2
Rumex paucifolius	G5	SP
Rumex utahensis	G5	SP
Salix athabascensis	G4G5	S2S3
Salix candida	G5	S3
Salix hookeriana	G5	S2
Salix nummularia	G5	SH
Salix planifolia ssp. *planifolia*	G5T5	S1
Salix prolixa	G5	S1
Salix setchelliana	G4	S3
Satureja douglasii	G4	S1
Saussurea americana	G5	S3
Saussurea sp. 1 (cf. triangulata)	G1	S1
Saxifraga adscendens ssp. *oregonensis*	G5T4T5	S2S3
Saxifraga aizoides	G5	S1
Saxifraga aleutica	G2G3	S2S3
Saxifraga nudicaulis	G3G4Q	S2S3
Saxifraga occidentalis	G5	S1
Saxifraga rivularis ssp. *arctolitoralis*	G5T2T3	S2S3
Saxifraga taylorii	G3	SP
Schizachne purpurascens	G5	S2
Schoenoplectus pungens	G5	S1
Schoenoplectus subterminalis	G4G5	S1
Scolochloa festucacea	G5	S1
Sedum divergens	G5?	S1

Scientific Name	Global Rank	State Rank
Sedum lanceolatum	G5	S1S2
Sedum oreganum	G5	S1S2
Senecio cannabifolius	G4?	S1S2
Sidalcea hendersonii	G3	S1
Silene uralensis ssp. *ogilviensis*	G4T1	S1?
Sisyrinchium montanum	G5	S1
Smelowskia johnsonii	G1	S1
Smelowskia media	G2G3	S2S3
Smelowskia pyriformis	G2	S2
Sphenopholis intermedia	G5	S1
Spiraea douglasii	G5	S3
Stachys emersonii	G5	S1
Stellaria alaskana	G3	S3
Stellaria dicranoides	G3	S3
Stellaria ruscifolia ssp. *aleutica*	G4T3	S3
Stellaria umbellata	G5	S2S3
Suaeda occidentalis	G5	S1
Symphoricarpos albus ssp. *laevigatus*	G5T5	S2
Symphyotrichum falcatum var. *falcatum*	G5T4T5	S1S2
Symphyotrichum pygmaeum	G2G4	S2
Symphyotrichum yukonense	G3	S3
Tanacetum bipinnatum ssp. *huronense*	G5T4T5	S3?
Taraxacum carneocoloratum	G3Q	S3
Taxus brevifolia	G4G5	S2
Thalictrum minus	GNR	S2S3
Thalictrum occidentale	G5	S1
Thlaspi arcticum	G3	S3
Thuja plicata	G5	S3
Tiarella trifoliata var. *laciniata*	G5T5?	S1S2
Townsendia hookeri	G5	S1
Trichophorum pumilum var. *rollandii*	G5	S1
Trifolium wormskjoldii	G5	S1
Trisetum sibiricum ssp. *litorale*	G5T4Q	S2
Trollius riederianus	G4G5	S1
Utricularia ochroleuca	G4?	S1?
Veronica grandiflora	G3	S3
Vicia americana	G5	S2
Viola selkirkii	G5?	S3
Viola sempervirens	G5	S1
Zannichellia palustris	G5	S3

354 records